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FINAL

WORK PLAN FOR SOIL SAMPLING AT THE LIVE IMPACT AREA VIEQUES ISLAND, PUERTO RICO

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities
Engineering Command
Norfolk, Virginia

Prepared by

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LIST OF ACRONYMS AND ABBREVIATIONS

AFWTF	Atlantic Fleet Weapons Training Facility
ATSDR	Agency for Toxic Substances and Disease Registry
Baker	Baker Environmental, Inc.
bgs	Below Ground Surface
CLP	Contract Laboratory Program
EMA	Eastern Maneuver Area
GPS	Global Positioning System
GIS	Geographic Information Systems
HASP	Health and Safety Plan
LANTDIV	Atlantic Division, Naval Facilities Engineering Command
LIA	Live Impact Area
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NASD	Naval Ammunition Support Detachment
NEESA	Naval Energy and Environmental Support Activity
NFESC	Naval Facilities Engineering Service Center
NSRR	Naval Station Roosevelt Roads
PPE	Personal Protective Equipment
PPM	parts per million
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedure
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance

1.0 INTRODUCTION AND PURPOSE

This Work Plan describes the proposed field activities that are to be conducted as part of the soil sampling for the Live Impact Area (LIA), Vieques, Puerto Rico. This work plan has been prepared by Baker Environmental, Inc. (Baker) under contract to the Atlantic Division, Naval Facility Engineering Command (LANTDIV), Contract Number N62470-89-D-4814.

The sampling and analysis program presented in this Work Plan is designed to provide soil sample analytical data to be used by the Agency for Toxic Studies and Disease Registry (ATSDR). A secondary objective of the program is to determine physical soil characteristics for use in an existing Navy air model. Figure 1-1 shows the general site location and the sampling area within the LIA.

2.0 SITE DESCRIPTION

Vieques Island lies approximately seven miles southeast of the U.S. Naval Station Roosevelt Roads (NSRR), Puerto Rico. The U.S. Navy occupies approximately 22,600 acres of the 33,000 acres that comprise Vieques Island. The 22,600 acres consists of the following: Naval Ammunition Storage Detachment (NASD) that occupies 8,000 acres along the western third of the island, the Eastern Maneuver Area (EMA) that occupies 11,000 acres located in the east-central portion of the island; the LIA that occupies 931 acres along the eastern portion of the island; and Atlantic Fleet Weapons Training Facility (AFWTF) that occupies 3,600 acres located between LIA and EMA. The LIA is undeveloped and utilized for live fire training for the U.S. Armed Forces. There is a high probability of encountering live ordnance during this investigation.

3.0 TECHNICAL APPROACH

This section describes the sampling program to be conducted at the LIA and background locations from June 19 to June 21, 2000. The following sections describe the activities associated with the sampling, which include collection, preservation, and shipping of samples; decontamination; sample analysis; and data validation. The overall sampling strategy, including the number and locations of samples, was determined in a meeting between LANTDIV and Baker that was conducted during the week of May 29, 2000.

3.1 Surface Soil Sampling

A series of surface soil samples will be obtained at the site from both within the LIA and at background locations. The following subsections describe the environmental and background surface soil samples to be collected.

3.1.1 Environmental Surface Soil Sampling

Thirty-seven surface soil samples will be collected at the LIA from the 0- to 6-inch below ground surface (bgs) interval. Table 3-1 presents the rationale for the sample locations and Figure 3-1 presents the locations of the samples. Generally, the sample locations were chosen in areas that are near target areas and in areas that are topographic lows (drainage ways) downgradient of target areas. The sample points were biased to locations that are easily accessible and where the chance of encountering unexploded ordnance (UXO) is lower.

The surface soil samples will be collected in accordance with USEPA Region II protocols. The area to be sampled will be screened by UXO personnel provided by the Contractor to verify that no ordnance is present and to establish a safe depth of sampling. Surface soil samples will be collected from 0- to 6-inches bgs unless the UXO personnel determine that a shallower interval (0- to 3-inches bgs) would be safer. If neither interval in an area is clear another safer location will be selected. After the sample area is cleared, the samples will be collected using a disposable stainless steel spoon or spatula and will be placed into an aluminum pie pan for homogenization. The soil type and color, relative moisture (e.g., dry, moist), and other notable characteristics (e.g., odor) will be recorded in the field book by site personnel. Attachment A contains the "Soil and Rock Sample Acquisition" and other applicable standard operating procedures (SOPs). Photographs will be taken at each location and recorded in a photo log.

The samples will have the identification nomenclature of LIA-SS-01 where:

LIA-SS-01 refers to the Live Impact Area
LIA-**SS**-01 refers to surface soil
LIA-SS-**01** refers to the sample number
LIA-SS-**01D** indicates duplicate sample

The samples will be placed into laboratory-prepared sample jars, properly packed within coolers to avoid breakage, and preserved with ice to a temperature of 4°C within the cooler. All coolers will be accompanied by a chain-of-custody documenting the samples within. Samples will be shipped daily to a stateside laboratory using an overnight carrier service. Attachment A contains the SOPs pertaining to sample preservation, chain-of-custody, sample packing, and shipping.

The samples will be analyzed for nitramine/nitroaromatic compounds, Attachment IX inorganics, and aluminum, manganese, picric acid, and ammonium perchlorate. Samples LIA-SS-3, LIA-SS-13, LIA-SS-17, LIA-SS-18, LIA-SS-21, and LIA-SS-27 will additionally be analyzed for grain size (sieve and hydrometer), moisture content, and bulk density to provide physical characteristics for future use in the air model. Table 3-2 presents the methods of analysis and describes the associated quality assurance/quality control (QA/QC) samples to be collected. Additional details on sample analysis are presented in the Quality Assurance Project Plan (QAPP) located in Attachment B.

3.1.2 Background Surface Soil Sampling

Five background surface soil samples will be collected during the sampling event. Two of the background soil samples will be collected west of the LIA in the EMA and three will be collected east of the LIA in the conservation area. All of the sample locations will be determined in the field prior to sampling. Figure 3-1 presents the general area of the background sample locations. Table 3-2 provides the analytical methods and describes the associated QA/QC samples to be collected.

The background samples will have the identification nomenclature of BKG-LIA-SS-01 where:

BKG-LIA-SS-01 refers to the background sample

BKG-**LIA**-SS-01 refers to the Live Impact Area

BKG-LIA-**SS**-01 refers to surface soil

BKG-LIA-SS-**01** refers to the sample number

BKG-LIA-SS-**01D** indicates duplicate sample

The background surface soil samples will be collected, preserved, and handled in the same manner as the environmental samples. The samples will be analyzed for nitramine/nitroaromatic compounds, Attachment IX inorganics, aluminum, manganese, picric acid and ammonium perchlorate. Table 3-2 presents the methods of analysis and describes the associated QA/QC samples to be collected.

3.2 Quality Assurance/Quality Control Sampling

QA/QC requirements for this investigation are described in this section.

Field Duplicate Samples

Field duplicates of the background and the LIA samples will be collected, homogenized, and split. Duplicate samples will be collected for one background sample and four environmental samples.

Matrix Spike/Matrix Spike Duplicates

Matrix Spike/Matrix Spike Duplicates(MS/MSDs) are laboratory derived and are collected to evaluate the matrix effect of the sample upon the analytical methodology. One MS/MSD analysis will be performed for every 20 soil samples collected.

Equipment Rinsates Blanks

Equipment rinsate blanks are collected of analyte-free water used to rinse decontaminated sampling equipment. Equipment rinsate blanks will be collected in the field and submitted to the analytical laboratory for analysis. The results from the blanks will be used to assess if the sampling equipment is free of contamination. The rinsate blanks are analyzed for the same parameters as the related samples. It is anticipated that a total of three equipment rinsate blanks will be collected.

3.3 Decontamination

As only new, dedicated sampling equipment will be used (aluminum pie pans and stainless steel sampling spoons or spatulas), no decontamination will be required.

3.4 Global Positioning System Survey

All of the surface soil sample locations will be surveyed using global positioning system (GPS) techniques. The GPS unit is a mapping and geographical information system (GIS) data capture system that uses satellites to obtain the northing and easting coordinates of the sample locations. These coordinates will be downloaded daily and placed in the GIS database for Vieques.

3.5 Sample Analysis

Laboratory analyses will include nitramine/nitroaromatic compounds, Attachment IX inorganics, aluminum, manganese, picric acid, ammonium perchlorate, grain size (sieve and hydrometer), bulk density, and moisture content. All samples will be analyzed using USEPA SW-846 methods with Level D QA/QC reporting as applicable. Other methods will be used for those parameters not addressed by SW-846. These analytical methods, their contract required detection limits or practical quantitation limits, and QA/QC procedures are described in the QAPP located in Attachment B. A summary of analyses by individual sample is presented in Table 3-2.

3.6 Chain of Custody

Chain-of-Custody procedures will be followed to ensure a documented, traceable link between measurement results and the sample they represent. These procedures are intended to provide a legally acceptable record for sample preparation, storage, and analysis.

To track sample custody transfer before ultimate disposition, sample custody will be documented using a chain-of-custody form similar to that shown in the QAPP.

A chain-of-custody form will be completed for each container in which samples are shipped. After samples are properly packaged, the shipping container will be sealed and prepared for shipment to the analytical laboratory. Custody seals will be placed on the outside of the containers to ensure that the samples are not disturbed prior to reaching the laboratory. An SOP for chain-of-custody procedures is included in Attachment A.

3.7 Data Validation

Data validation will be performed by an independent, third party data validator for all samples. The procedures for validation will follow the Level D guidelines listed in Sampling and Chemical Analysis Quality Assurance for Navy Installation Restoration Program Naval Energy and Environmental Support Activity (NEESA) guidance document NEESA 20.2-047B, 1998. Further details concerning data validation are contained in the QAPP.

TABLES

TABLE 3-1
SOIL SAMPLE LOCATION AND RATIONALE
LIVE IMPACT AREA WORK PLAN
VIEQUES ISLAND, PURTO RICO

Sample Number	Sample Location*	Sample Rationale
1	Target 1 North	Downgradient of Target 1 and Strafe Area; north of Target 1 and equidistant to shoreline
2	Target 1 South	Topographic low area, downgradient of Target 1 and SAM West
3	Lagoon 1 North	Assess impact of Target 1 and SAM West on Lagoon 1
4	Lagoon 1 East	Low portion of Strafe area which could affect Lagoon 1
5	South Strafe – Beach Line	Located close to shoreline; assess impacts of Strafe area
5D	South Strafe – Beach Line	Duplicate
6	East Strafe	Located in topographic low area; potential drainage way from SAM West
7	SAM West – South East	Located in topographic low area; potential drainage way from SAM West
8	SAM West – South West	Located in topographic low area; potential drainage way from SAM West
9	CE 1001 – Beach	Potential drainage feature from CE 1001; Closest to shoreline
10	CE 1001 – East	Located between Lagoon 3 and CE 1001
11	South Convoy – North	Located between South Convoy and Lagoon 3
12	South Convoy – South	Located south of South Convoy and north of shoreline
13	CE 1002	Located between CE 1002 and Lagoon 3
14	Lagoon 2 – South	Topographic low area; Influenced by CE 1001, CE 1002, and SAM West; assess impacts on Lagoon 2
14D	Lagoon 2 – South	Duplicate
15	SAM West – North	Topographic low area; North of SAM West, between SAM West and shoreline
16	Lagoon 3 – North	Located within a topographic low area north of Lagoon 3
17	RR Tunnel – East	Located within a topographic low area northeast of Lagoon 3 and RR Tunnel
18	Open Disposal of Ordnance Area – West	Located southwest of RR Tunnel between RR Tunnel and Lagoon 3
19	Open Disposal of Ordnance Area – Lagoon 3	Located in ordnance disposal unit northeast of Lagoon 3
20	Center A/C Revetment	Assess impacts on Lagoon 3
21	Runway Center	Assess impacts on Lagoon 3
22	South A/C Revetment – East	Assess impacts on Lagoon 3
23	South A/C Revetment – West	Assess impacts on Lagoon 3
23D	South A/C Revetment – West	Duplicate
24	Runway – South West	Assess impacts on Lagoon 3
25	Runway – South	Assess impacts on Lagoon 3
26	Lagoon 3 – South	Assess impacts on Lagoon 3
27	CE 1005 – North West	Runoff from fuel farm and CE 1005

TABLE 3-1 (continued)
SOIL SAMPLE LOCATION AND RATIONALE
LIVE IMPACT AREA WORK PLAN
VIEQUES ISLAND, PURTO RICO

Sample Number	Sample Location*	Sample Rationale
28	CE 1005 – South East	Runoff from CE 1005 to shoreline
29	CE 1005 – South West	Runoff from CE 1005 to shoreline
30	Target 6	Runoff from Target 6
31	Target 5	Runoff from CE 1004 to shoreline
32	Ammo Dump – West	Runoff from Ammo Dump
33	Ammo Dump – Northeast	Runoff from Ammo Dump
33D	Ammo Dump – Northeast	Duplicate
34	Fuel Farm – North	Runoff from Fuel Farm
35	Fuel Farm – West	Runoff from Fuel Farm
36	SAM East – North West	North orientation
37A	SAM East – East	Runoff from SAM East
37B	South East Corner LIA	Assess south east corner of LIA
BKG1	Conservation Zone Class 1 – East of LIA	Background sample locations to be determined in field
BKG2	Conservation Zone Class 1 – East of LIA	Background sample locations to be determined in field
BKG3	Conservation Zone Class 1 – East of LIA	Background sample locations to be determined in field
BKG4	EMA– West of LIA	Background sample locations to be determined in field
BKG5	EMA – West of LIA	Background sample locations to be determined in field
BKG5D	EMA - West of LIA	Duplicate

* No samples will be taken from the lagoon. The term lagoon is used to identify certain sample locations.

TABLE 3-2
SUMMARY OF SAMPLE ANALYSIS
LIVE IMPACT AREA WORK PLAN
VIEQUES ISLAND, PUETO RICO

				Environmental Parameters						Engineering Parameters		
Sample Number	Sample Lab ID	Media	MS/MSD Sample	Appendix IX Inorganics [1] SW846-6010B	Aluminum SW846-6010B	Manganese SW846-6010B	Nitramine Compounds SW846-8330	Picric Acid SW846-8330	Ammonium Perchlorate 300.0 (IC)	Grain Size Analysis (Sieve & Hydrometer) ASTM D442	Moisture Content ASTM D2216	Bulk Density ASTM D2937
1	LIA-SS-01	Surface Soil		X	X	X	X	X	X			
2	LIA-SS-02	Surface Soil		X	X	X	X	X	X			
3	LIA-SS-03	Surface Soil		X	X	X	X	X	X	X	X	X
4	LIA-SS-04	Surface Soil		X	X	X	X	X	X			
5	LIA-SS-05	Surface Soil	X	X	X	X	X	X	X			
5D	LIA-SS-05D	Surface Soil		X	X	X	X	X	X			
6	LIA-SS-06	Surface Soil		X	X	X	X	X	X			
7	LIA-SS-07	Surface Soil		X	X	X	X	X	X			
8	LIA-SS-08	Surface Soil		X	X	X	X	X	X			
9	LIA-SS-09	Surface Soil		X	X	X	X	X	X			
10	LIA-SS-10	Surface Soil		X	X	X	X	X	X			
11	LIA-SS-11	Surface Soil		X	X	X	X	X	X			
12	LIA-SS-12	Surface Soil		X	X	X	X	X	X			
13	LIA-SS-13	Surface Soil		X	X	X	X	X	X	X	X	X
14	LIA-SS-14	Surface Soil		X	X	X	X	X	X			
14D	LIA-SS-14D	Surface Soil		X	X	X	X	X	X			
15	LIA-SS-15	Surface Soil		X	X	X	X	X	X			
16	LIA-SS-16	Surface Soil		X	X	X	X	X	X			
17	LIA-SS-17	Surface Soil		X	X	X	X	X	X	X	X	X
18	LIA-SS-18	Surface Soil		X	X	X	X	X	X	X	X	X
19	LIA-SS-19	Surface Soil		X	X	X	X	X	X			
20	LIA-SS-20	Surface Soil		X	X	X	X	X	X			
21	LIA-SS-21	Surface Soil		X	X	X	X	X	X			
22	LIA-SS-22	Surface Soil		X	X	X	X	X	X	X	X	X
23	LIA-SS-23	Surface Soil		X	X	X	X	X	X			
23D	LIA-SS-23D	Surface Soil		X	X	X	X	X	X			
24	LIA-SS-24	Surface Soil		X	X	X	X	X	X			
25	LIA-SS-25	Surface Soil		X	X	X	X	X	X			
26	LIA-SS-26	Surface Soil		X	X	X	X	X	X			
27	LIA-SS-27	Surface Soil		X	X	X	X	X	X	X	X	X
28	LIA-SS-28	Surface Soil		X	X	X	X	X	X			
29	LIA-SS-29	Surface Soil		X	X	X	X	X	X			
30	LIA-SS-30	Surface Soil		X	X	X	X	X	X			
31	LIA-SS-31	Surface Soil		X	X	X	X	X	X			
32	LIA-SS-32	Surface Soil		X	X	X	X	X	X			
33	LIA-SS-33	Surface Soil		X	X	X	X	X	X			
33D	LIA-SS-33D	Surface Soil		X	X	X	X	X	X			
34	LIA-SS-34	Surface Soil	X	X	X	X	X	X	X			
35	LIA-SS-35	Surface Soil		X	X	X	X	X	X			
36	LIA-SS-36	Surface Soil		X	X	X	X	X	X			
37A	LIA-SS-37A	Surface Soil		X	X	X	X	X	X			
37B	LIA-SS-37B	Surface Soil		X	X	X	X	X	X			
BKG1	BKG-LIA-SS-01	Surface Soil		X	X	X	X	X	X			
BKG2	BKG-LIA-SS-02	Surface Soil		X	X	X	X	X	X			
BKG3	BKG-LIA-SS-03	Surface Soil		X	X	X	X	X	X			
BKG4	BKG-LIA-SS-04	Surface Soil		X	X	X	X	X	X			
BKG5	BKG-LIA-SS-05	Surface Soil		X	X	X	X	X	X			
BKG5D	BKG-LIA-SS-05D	Surface Soil		X	X	X	X	X	X			

Notes:
X = Requested Analysis
(1) = Appendix IX Inorganics include: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, and zinc
MS/MSD = Matrix Spike/Matrix Spike Duplicate

FIGURES

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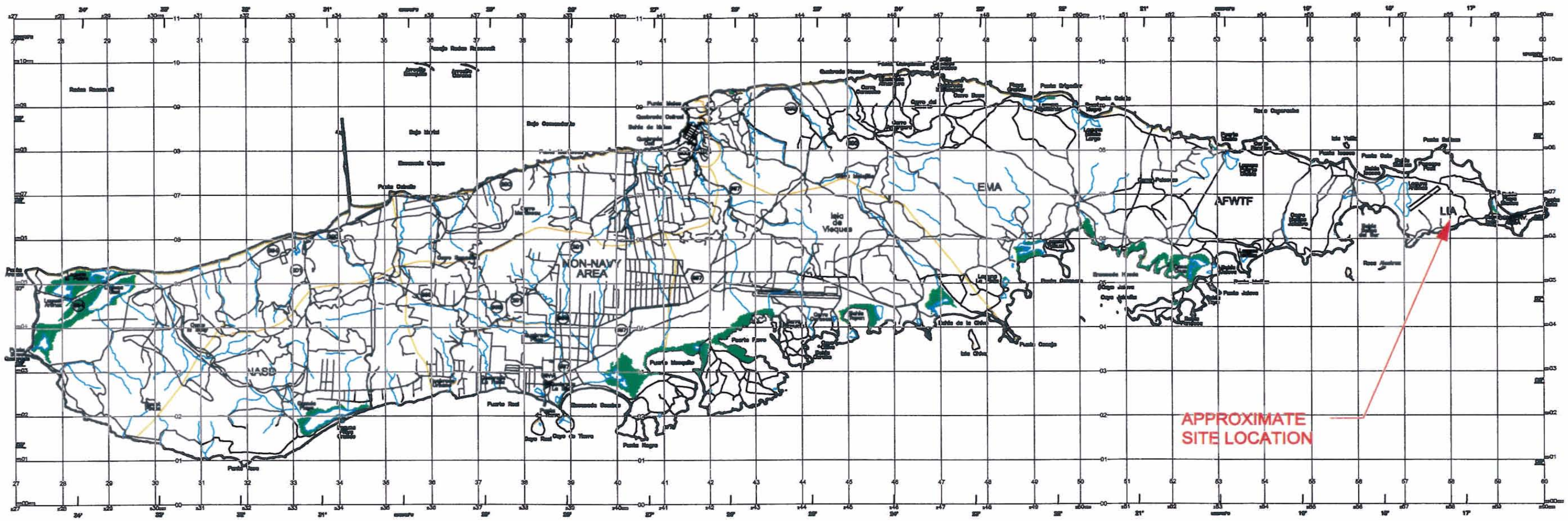

0 1000 3000 5000

1 CM = 1000 M

Baker

FIGURE 1-1
SITE LOCATION MAP

VIEQUES ISLAND
PUERTO RICO

LEGEND

- AIR TO GROUND TARGET
- NAVAL SURFACE FIRE SUPPORT TARGET
- DAY TARGET
- PROPOSED SURFACE SOIL SAMPLE LOCATION
- CONSERVATION ZONE CLASS 1
- CONSERVATION ZONE CLASS 2
- APPROXIMATE WETLAND BOUNDARY
- LIMITS OF MANGROVE
- SEA TURTLE
- 10M CONTOUR
- 1M CONTOUR

0 50 100 150 200 250
1 CM = 50 M

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NORTH

VIEQUES ISLAND
PUERTO RICO

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

Baker

PROPOSED SAMPLE LOCATION MAP

FIGURE NO. 3-1

SCALE AS SHOWN

DATE JUNE 16, 2000

ATTACHMENT A
STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE

SAMPLE PRESERVATION AND HANDLING

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SOP Number: F301
Effective Date: 04/94

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SAMPLE PRESERVATION AND HANDLING

1.0 PURPOSE

This SOP describes the appropriate containers for samples of particular matrices, and the steps necessary to preserve those samples when shipped off site for chemical analysis. It also identifies the qualifications for individuals responsible for the transportation of hazardous materials and samples and the regulations set forth by the Department of Transportation regarding the same.

2.0 SCOPE

Some chemicals react with sample containers made of certain materials; for example, trace metals adsorb more strongly to glass than to plastic, while many organic chemicals may dissolve various types of plastic containers. It is therefore critical to select the correct container in order to maintain the integrity of the sample prior to analysis.

Many water and soil samples are unstable and may change in chemical character during shipment. Therefore, preservation of the sample may be necessary when the time interval between field collection and laboratory analysis is long enough to produce changes in either the concentration or the physical condition of the constituent(s). While complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that may occur after the sample is collected.

Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/freezing. Their purposes are to (1) retard biological activity, (2) retard hydrolysis of chemical compounds/complexes, (3) reduce constituent volatility, and (4) reduce adsorption effects.

Typical sample container and preservation requirements for this project are provided in Attachment A of this SOP. Note that sample container requirements (i.e., volumes) may vary by laboratory.

The Department of Transportation, Code of Federal Regulations (CFR) Title 49 establishes regulations for all materials offered for transportation. The transportation of environmental samples for analysis is regulated by Code of Federal Regulations Title 40 (Protection of the Environment), along with 49 CFR Part 172 Subpart H. The transportation of chemicals used as preservatives and samples identified as hazardous (as defined by 49 CFR Part 171.8) are regulated by 49 CFR Part 172.

3.0 DEFINITIONS

HCl - Hydrochloric Acid

H_2SO_4- Sulfuric Acid

HNO_3 - Nitric Acid

NaOH - Sodium Hydroxide

Normality (N) - Concentration of a solution expressed as equivalents per liter, where an equivalent is the amount of a substance containing one mole of replaceable hydrogen or its equivalent. Thus, a one molar solution of HCl, containing one mole of H, is "one-normal," while a one molar solution of H_2SO_4 containing two moles of H, is "two-normal."

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is also responsible for proper certification of individuals responsible for transportation of samples of hazardous substances.

Field Team Leader - It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures. The Field Team Leader is responsible to ensure all samples and/or hazardous substances are properly identified, labeled, and packaged prior to transportation.

Sampling Personnel - It is the responsibility of the field sampling personnel to initiate sample preservation and handling. It is also the responsibility of the field sampling personnel to understand and adhere to the requirements for proper transportation of samples and/or hazardous substances.

5.0 PROCEDURES

The following procedures discuss sample containerization and preservation techniques that are to be followed when collecting environmental samples for laboratory analysis.

5.1 Sample Containers

For most samples and analytical parameters either glass or plastic containers are satisfactory. In general, if the analyte(s) to be measured is organic in nature, the container shall be made of glass. If the analyte(s) is inorganic, then glass or plastic containers may be used. Containers shall be kept out of direct sunlight (to minimize biological or photo-oxidation/photolysis of constituents) until they reach the analytical laboratory. The sample container shall have approximately five to ten percent air space ("ullage") to allow for expansion/vaporization if the sample is heated during transport (one liter of water at 4°C expands by 15 milliliters if heated to 130°F/55°C); however, head space for volatile organic analyses shall be omitted.

The analytical laboratory shall provide sample containers that have been certified clean according to USEPA procedures. Shipping containers for samples, consisting of sturdy ice chests, are to be provided by the laboratory.

Once opened, the sample container must be used at once for storage of a particular sample. Unused, but opened, containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or missing liners (if required for the container) shall be discarded.

General sample container, preservative, and holding time requirements are listed in Attachment A.

5.2 Preservation Techniques

The preservation techniques to be used for various analytes are listed in Attachment A. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or added in the field using laboratory supplied preservatives. Some of the more commonly used sample preservation techniques include storage of sample at a temperature of 4°C, acidification of water samples, and storage of samples in dark (i.e. amber) containers to prevent the samples from being exposed to light.

All samples shall be stored at a temperature of 4°C. Additional preservation techniques shall be applied to water samples as follows:

- Water samples to be analyzed for volatile organics shall be acidified.
- Water samples to be analyzed for semivolatile organics shall be stored in dark containers.
- Water samples to be analyzed for pesticides/PCBs shall be stored in dark containers.
- Water samples to be analyzed for inorganic compounds shall be acidified.

These preservation techniques generally apply to samples of low-level contamination. The preservation techniques utilized for samples may vary. However, unless documented otherwise in the project plans, all samples shall be considered low concentration. All samples preserved with chemicals shall be clearly identified by indicating on the sample label that the sample is preserved.

5.3 Sample Holding Times

The elapsed time between sample collection and initiation of laboratory analyses is considered the holding time and must be within a prescribed time frame for each individual analysis to be performed. Sample holding times for routine sample collection are provided in Attachment A.

6.0 SAMPLE HANDLING AND TRANSPORTATION

After collection, the outside of all sample containers will be wiped clean with a damp paper towel; however sample handling should be minimized. Personnel should use extreme care to ensure that samples are not contaminated. If samples are placed in an ice chest, personnel should ensure that melted ice cannot cause sample containers to become submerged, as this may result in sample cross-contamination and loss of sample labels. Sealable plastic bags, (zipper-type bags), should be used when glass sample containers are placed in ice chests to prevent cross-contamination, if breakage should occur.

Samples may be hand delivered to the laboratory or they may be shipped by common carrier. Relevant regulations for the storage and shipping of samples are contained in 40 CFR 261.4(d). Parallel state regulations may also be relevant. Shipment of dangerous goods by air cargo is also regulated by the United Nations/International Civil Aviation Organization (UN/ICAO). The Dangerous Goods Regulations promulgated by the International Air Transport Association (IATA) meet or exceed DOT and UN/ICAO requirements and should be used for shipment of dangerous goods via air cargo. Standard procedures for shipping environmental samples are given in Attachment B.

7.0 REFERENCES

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Protection of the Environment, Code of Federal Regulation, Title 40, Parts 260 to 299.

Transportation, Code of Federal Regulation, Title 49, Parts 100 to 177.

ATTACHMENT A

REQUIRED CONTAINER, PRESERVATION TECHNIQUES AND HOLDING TIMES

ATTACHMENT B

SAMPLE SHIPPING PROCEDURES

ATTACHMENT B

SAMPLE SHIPPING PROCEDURES

Introduction

Samples collected during field investigations or in response to a hazardous materials incident must be classified by the project leader, prior to shipping by air, as either environmental or hazardous substances. The guidance for complying with U.S. DOT regulations in shipping environmental laboratory samples is given in the "National Guidance Package for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples."

Pertinent regulations for the shipping of environmental samples is given in 40 CFR 261.4(d). Samples collected from process wastewater streams, drums, bulk storage tanks, soil, sediment, or water samples from areas suspected of being highly contaminated may require shipment as dangerous goods/hazardous substance. Regulations for packing, marking, labeling, and shipping of dangerous goods by air transport are promulgated by the United Nations International Civil Aviation Organization (UN/ICAO),which is equivalent to IATA.

Individuals responsible for transportation of environmental samples or dangerous goods/hazardous substances must be tested and certified by their employer. This is required by 49 CFR Part 172 Subpart H Docket HM-126 to assure the required qualifications for individuals offering materials for transportation.

Environmental samples shall be packed prior to shipment by commercial air carrier using the following procedures:

1. Select a sturdy cooler in good repair. Secure and tape the drain plug (inside and outside) with fiber or duct tape. Line the cooler with a large heavy duty plastic bag. This practice keeps the inside of the cooler clean and minimizes cleanup at the laboratory after samples are removed.

2. Allow sufficient headspace (ullage) in all bottles (except VOAs) to compensate for any pressure and temperature changes (approximately 10 percent of the volume of the container).

3. Be sure the lids on all bottles are tight (will not leak). In many regions custody seals are also applied to sample container lids. The reason for this practice is two-fold: to maintain integrity of samples and keep lid on the container should the lid loosen during shipment. Check with the appropriate regional procedures prior to field work. In many cases, the laboratory manager of the analytical lot to be used on a particular project can also provide this information.

4. It is good practice to wrap all glass containers in bubblewrap or other suitable packing material prior to placing in plastic bags.

5. Place all bottles in separate and appropriately sized polyethylene bags and seal the bags with tape (preferably plastic electrical tape, unless the bag is a zipper-type bag). Up to three VOA bottles, separately wrapped in bubblewrap, may be packed in one plastic bag.

6. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite.

7. Place two to four inches of vermiculite (ground corn cob, or other inert packing material) in the bottom of the cooler and then place the bottles and cans in the cooler with sufficient space to allow for the addition of more vermiculite between the bottles and cans.

8. Put frozen "blue ice" (or ice that has been placed in properly sealed, double-bagged, heavy duty polyethylene bags) on top of and between the samples. Fill all remaining space between the bottles or cans with packing material. Fold and securely fasten the top of the large heavy duty plastic bag with tape (preferably electrical or duct).

9. Place the Chain-of-Custody Record and the Request for Analysis Form (if applicable) into a plastic bag, tape the bag to the inner side of the cooler lid, and then close the cooler and securely tape (preferably with fiber tape) the top of the cooler unit. Wrap the tape three to four times around each side of the cooler unit. Chain-of-custody seals should be affixed to the top and sides of the cooler within the securing tape so that the cooler cannot be opened without breaking the seal.

10. Each cooler (if multiple coolers) should have its own Chain-of-Custody Record reflecting the samples shipped in that cooler.

11. Label according to 40 CFR 261.4(d). The shipping containers should be marked "THIS END UP," and arrow labels which indicate the proper upward position of the container should be affixed to the container. A label containing the name and address of the shipper and laboratory shall be placed on the outside of the container. It is good practice to secure this label with clear plastic tape to prevent removal during shipment by blurring of important information should the label become wet. The commercial carrier is not required to sign the COC record as long as the custody seals remain intact and the COC record stays in the cooler. The only other documentation required is the completed airbill, which is secured to the top of the shipping container. Please note several coolers/shipping containers may be shipped under one airbill. However, each cooler must be labeled as "Cooler 1 of 3, Cooler 2 of 3, etc.", prior to shipping. Additionally it is good practice to label each COC form to correspond to each cooler (i.e., 1 of 3, 2 of 3, etc.).

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SOIL AND ROCK SAMPLE ACQUISITION **Effective Date: 04/94**

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SOIL AND ROCK SAMPLE ACQUISITION

1.0 PURPOSE

The purpose of this procedure is to describe the handling of rock cores and subsurface soil samples collected during drilling operations. Surface soil sampling also is described.

2.0 SCOPE

The methods described in this SOP are applicable for the recovery of subsurface soil and rock samples acquired by coring operations or soil sampling techniques such as split-barrel sampling and thin-walled tube sampling. Procedures for the collection of surface soil samples also are discussed. This SOP does not discuss drilling techniques or well installation procedures. ASTM procedures for "Penetration Test and Split-Barrel Sampling of Soils," "Thin-Walled Tube Sampling of Soils," and "Diamond Core Drilling for Site Investigation" have been included as Attachments A through C, respectively.

3.0 DEFINITIONS

Thin-Walled Tube Sampler - A thin-walled metal tube (also called Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches outer diameter (O.D.) and 18 to 54 inches length.

Split-Barrel Sampler - A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. Also called a split-spoon sampler, this device can be driven into unconsolidated materials using a drive weight mounted on the drilling string. A standard split-spoon sampler (used for performing Standard Penetration Tests) is two inches O.D. and 1-3/8-inches inner diameter (I.D.). This standard spoon is available in two common lengths providing either 20-inch or 26-inch internal longitudinal clearance for obtaining 18-inch or 24-inch long samples, respectively.

Grab Sample - An individual sample collected from a single location at a specific time or period of time generally not exceeding 15 minutes. Grab samples are associated with surface water, groundwater, wastewater, waste, contaminated surfaces, soil, and sediment sampling. Grab samples are typically used to characterize the media at a particular instant in time.

Composite Samples - A sample collected over time that typically consists of a series of discrete samples which are combined or "composited." Two types of composite samples are listed below:

- Areal Composite: A sample collected from individual grab samples collected on an areal or cross-sectional basis. Areal composites shall be made up of equal volumes of grab samples. Each grab sample shall be collected in an identical manner. Examples include sediment composites from quarter-point sampling of streams and soil samples from grid points.

- Vertical Composite: A sample collected from individual grab samples collected from a vertical cross section. Vertical composites shall be made up of equal volumes of grab samples. Each grab sample shall be collected in an identical manner. Examples include vertical profiles of soil/sediment columns, lakes and estuaries.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for ensuring that, where applicable, project-specific plans are in accordance with these procedures, or that other approved procedures are developed. Furthermore, the Project Manager is responsible for development of documentation of procedures which deviate from those presented herein.

Field Team Leader - The Field Team Leader is responsible for selecting and detailing the specific sampling techniques and equipment to be used, and documenting these in accordance with the Sampling and Analysis Plan. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Drilling Inspector - It is the responsibility of the drilling inspector to follow these procedures, or to follow documented, project-specific procedures as directed by the Field Team Leader and/or the Project Manager. The Drilling Inspector is responsible for the proper acquisition of rock cores and subsurface soil samples.

Sampling Personnel - It is the responsibility of the field sampling personnel to follow these procedures, or to follow documented, project-specific procedures as directed by the Field Team Leader and/or the Project Manager. The sampling personnel are responsible for the proper acquisition of samples.

5.0 PROCEDURES

Subsurface soil and rock samples are used to characterize the three-dimensional subsurface stratigraphy. This characterization can indicate the potential for migration of contaminants from various sites. In addition, definition of the actual migration of contaminants can be obtained through chemical analysis of subsurface soil samples. Where the remedial activities may include in-situ treatment, or the excavation and removal of the contaminated soil, the depth and areal extent of contamination must be known as accurately as possible.

Surface soil samples serve to characterize the extent of surface contamination at various sites. These samples may be collected during initial site screening to determine gross contamination levels and levels of personal protection required as part of more intensive field sampling activities, to gather more detailed site data during design, or to determine the need for, or success of, cleanup actions.

Site construction activities may require that the engineering and physical properties of soil and rock be determined. Soil types, bearing strength, compressibility, permeability, plasticity, and moisture content are some of the geotechnical characteristics that may be determined by laboratory tests of soil samples. Rock quality, strength, stratigraphy, structure, etc. often are needed to design and construct deep foundations or remedial components.

5.1 Subsurface Soil Samples

This section discusses four methods for collecting subsurface soil samples: (1) split-spoon sampling; (2) shelby tube sampling; (3) bucket auger sampling; and direct push sampling. All four methods yield samples suitable for laboratory analysis. Copies of the ASTM procedures for split-spoon sampling, shelby-tube sampling and direct push sampling are provided in Attachments A, B and C, respectively.

5.1.1 Split-Barrel (Split-Spoon) Sampling

The following procedures are to be used for split-spoon, geotechnical soil sampling:

1. Clean out the borehole to the desired sampling depth using equipment that will ensure that the material to be sampled is not disturbed by the operation.

2. Side-discharge or bottom-discharge bits are permissible. The process of jetting through the sampler and then sampling when the desired depth is reached shall not be permitted. Where casing is used, it may not be driven below the sampling elevation.

3. The two-inch O.D. split-barrel (not for geotech) sampler should be driven with blows from a 140-pound hammer falling 30 inches in accordance with ASTM D1586-84, Standard Penetration Test.

4. Repeat this operation at intervals not longer than 5 feet in homogeneous strata, or as specified in the Sampling and Analysis Plan.

5. Record on the Field Test Boring Record or field logbook the number of blows required to effect each six inches of penetration or fraction thereof. The first six inches is considered to be a seating drive. The sum of the number of blows required for the second and third six inches of penetration is termed the penetration resistance, N. If the sampler is driven less than 18 inches, the penetration resistance is that for the last one foot of penetration. (If less than one foot is penetrated, the logs shall state the number of blows and the fraction of one foot penetrated.) In cases where samples are driven 24 inches, the sum of second and third six-inch increments will be used to calculate the penetration resistance. (Refusal of the Standard Penetration Test will be noted as 50 blows over an interval equal to or less than 6 inches; the interval driven will be noted with the blow count.)

6. Bring the sampler to the surface and remove both ends and one half of the split-spoon such that the soil recovered rests in the remaining half of the barrel. Describe carefully the recovery (length), composition, structure, consistency, color, condition, etc. of the recovered soil according to SOP F101; then put into jars without ramming. Jars with samples not taken for chemical analysis should be tightly closed, to prevent evaporation of the soil moisture. Affix labels to the jar and complete Chain-of-Custody and other required sample data forms (see SOP F302). Protect samples against extreme temperature changes and breakage by placing them in appropriate cartons stored in a protected area.

In addition to collecting soils for geotechnical purposes, split-spoon sampling can be employed to obtain samples for environmental analytical analysis. The following procedures are to be used for split-spoon, environmental soil sampling:

1. Follow sample collection procedures 1 through 6 as outlined in Section 5.1.1.

2. After sample collection, remove the soil from the split-spoon sampler. Prior to filling laboratory containers, the soil sample should be mixed thoroughly as possible to ensure that the sample is as representative as possible of the sample interval. Soil samples for volatile organic compounds should not be mixed. Further, sample containers for volatile organic compounds analyses should be filled completely without head space remaining in the container to minimize volatilization.

3. Record all pertinent sampling information such as soil description, sample depth, sample number, sample location, and time of sample collection in the Field Test Boring Record or field logbook. In addition, label, tag, and number the sample bottle(s).

4. Pack the samples for shipping (see SOP F301). Attach seal to the shipping package. Make sure that Chain-of-Custody Forms and Sample Request Forms are properly filled out and enclosed or attached (see SOP F302).

5. Decontaminate the split-spoon sample as described in SOP F501 and SOP F502. Replace disposable latex gloves between sample stations to prevent cross-contaminating samples.

For obtaining composite soil samples (see Section 3.0), a slightly modified approach is employed. Each individual discrete soil sample from the desired sample interval will be placed into a stainless-steel, decontaminated bowl (or other appropriate container) prior to filling the laboratory sample containers. Special care should be taken to cover the bowl between samples with aluminum foil to minimize volatilization. Immediately after obtaining soils from the desired sampling interval, the sample to be analyzed for Volatile Organic Compounds (VOCs) should be collected. In the event that a composite sample is required, care should be taken to obtain a representative sampling of each sample interval. The remaining soils should be thoroughly mixed. Adequate mixing can be achieved by stirring in a circular fashion and occasionally turning the soils over. Once the remaining soils have been thoroughly combined, samples for analyses other than VOCs should be placed into the appropriate sampling containers.

5.1.2 Thin-Wall (Shelby Tube) Sampling

When it is desired to take undisturbed samples of soil for physical laboratory testing, thin-walled seamless tube samplers (Shelby tubes) will be used. The following method applies:

1. Clean out the hole to the sampling elevation, being careful to minimize the chance for disturbance or contamination of the material to be sampled.

2. The use of bottom discharge bits or jetting through an open-tube sampler to clean out the hole shall not be allowed. Only side discharge bits are permitted.

3. Prior to inserting the tube sampler in the hole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out of the tube sampler during sample withdrawal and to maintain a suction within the tube to help retain the sample.

4. With the sampling tube resting on the bottom of the hole and the water level in the boring at the natural groundwater level or above, push the tube into the soil by a continuous and rapid motion, without impacting or twisting. In no case shall the tube be pushed further than the length provided for the soil sample. Allow a free space in the tube for cuttings and sludge.

5. After pushing the tube, the sample should sit 5 to 15 minutes prior to removal. Immediately before removal, the sample must be sheared by rotating the rods with a pipe wrench a minimum of two revolutions.

6. Upon removal of the sampler tube from the hole, measure the length of sample in the tube and also the length penetrated. Remove disturbed material in the upper end of the tube and measure the length of sample again. After removing at least an inch of soil, from the lower end and after inserting an impervious disk, seal both ends of the tube with at least a 1/2-inch thickness of wax applied in a way that will prevent the wax from entering the sample. Newspaper or other types of filler must be placed in voids at either end of the sampler prior to sealing with wax. Place plastic caps on the ends of the sampler, tape them into place and then dip the ends in wax to seal them.

7. Affix labels to the tubes and record sample number, depth, penetration, and recovery length on the label. Mark the same information and "up" direction on the tube with indelible ink, and indicate the top of the sample. Complete chain-of-custody and other required forms (see SOP F302). Do not allow tubes to freeze, and store the samples vertically (with the same orientation they had in the ground, i.e., top of sample is up) in a cool place out of the sun at all times. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

8. From soil removed from the ends of the tube, make a careful description using the methods presented in SOP F101.

9. When thin-wall tube samplers are used to collect soil for certain chemical analyses, it may be necessary to avoid using wax, newspaper, or other fillers.

Thin-walled undisturbed tube samplers are restricted in their usage by the consistency of the soil to be sampled. Often very loose and/or wet samples cannot be retrieved by the samplers, and soils with a consistency in excess of very stiff cannot be penetrated by the sampler. Other appropriate devices can be used in conjunction with the tube samplers to obtain undisturbed samples of stiff soils. Using these devices normally increases sampling costs and, therefore, their use should be weighed against the increased cost and the need for an undisturbed sample. In any case, if a sample cannot be obtained with a tube sampler, an attempt should be made with a split-spoon sampler at the same depth so that at least one sample can be obtained for classification purposes.

5.1.3 Bucket (Hand) Auger Sampling

Hand augering is the most common manual method used to collect subsurface samples. Typically, 4-inch auger buckets with cutting heads are pushed and twisted into the ground and removed as the buckets are filled. The auger holes are advanced one bucket at a time. The practical depth of investigation using a hand auger is related to the material being sampled. In sands, augering is usually easily accomplished, but the depth of investigation is controlled by the depth at which sands begin to cave. At this point, auger holes usually begin to collapse and cannot practically be advanced to lower depths, and further samples, if required, must be collected using some type of pushed or driven device. Hand augering may also become difficult in tight clays or cemented sands. At depths approaching 20 feet, torquing of hand auger extensions becomes so severe that in resistant materials powered methods must be used.

When a vertical sampling interval has been established, one auger bucket is used to advance the auger hole to the first desired sampling depth. If the sample at this location is to be a vertical composite of all intervals, the same bucket may be used to advance the hole, as well collect subsequent samples in the same hole. However, if discrete grab samples are to be collected to characterize each depth, a decontaminated bucket must be placed on the end of the auger extension immediately prior to collecting the next sample. The top several inches of soil should be removed from the bucket to minimize the chances of cross-contamination of the sample from fall-in of material from the upper portions of the hole. The bucket auger should be decontaminated between samples as outlined in SOP F502.

In addition to hand augering, powered augers can be used to advance a boring for subsurface soil collection. However, this type of equipment is technically a sampling aid and not a sampling device, and 20 to 25 feet is the typical lower depth range for this equipment. It is used to advance a hole to the required sample depth, at which point a hand auger is usually used to collect the sample.

5.1.4 Direct Push Sampling

Direct push sampling has become a widely used technique for collecting environmental samples of soil and groundwater. There are multiple sampling devices and different sized samplers used in direct push methods. Please refer to ASTM standards in attachment D. This is a general procedure for sampling and could change depending on work plan and type of sampling being done.

1. The sampler should be driven to desired depth for sample.

2 Bring the sampler to the surface and remove soil sleeve. Record all pertinent sampling information such as soil description, sample depth, sample number, sample location, and time of sample collection in the Field Test Boring Record or field logbook. In addition, label, tag, and number the sample bottle(s). Affix labels to the jar and complete Chain-of-Custody and other required sample data forms (see SOP F302).

3. After sample collection, remove the soil from the sampler. Prior to filling laboratory containers, the soil sample should be mixed thoroughly as possible to ensure that the sample is as representative as possible of the sample interval. <u>Soil samples for volatile organic compounds should not be mixed.</u> Further, sample containers for volatile organic

compounds analyses should be filled completely without head space remaining in the container to minimize volatilization.

4. Pack the samples for shipping (see SOP F301). Attach seal to the shipping package. Make sure that Chain-of-Custody Forms and Sample Request Forms are properly filled out and enclosed or attached (see SOP F302).

5. Decontaminate the sampler as described in SOP F501 and SOP F502. Replace disposable latex gloves between sample stations to prevent cross-contaminating samples.

5.2 Surface Soil Samples

Surface soils are generally classified as soils between the ground surface and 6 to 12 inches below ground surface. For loosely packed surface soils, stainless steel (organic analyses) or plastic (inorganic analyses) scoops or trowels, can be used to collect representative samples. For densely packed soils or deeper soil samples, a hand or power soil auger may be used.

The following methods are to be used:

1. Use a soil auger for deep samples (greater than 12 inches) or a scoop or trowel for surface samples. Remove debris, rocks, twigs, and vegetation before collecting the sample.

2. Immediately transfer the sample to the appropriate sample container. Attach a label and identification tag. Record all required information in the field logbook (SOP F303) and on the sample log sheet, chain-of-custody record (SOP F302), and other required forms.

3. Classify and record a description of the sample, as discussed in SOP F101. Descriptions for surface soil samples should be recorded in the field logbook; descriptions for soil samples collected with power or hand augers shall be recorded on a Field Test Boring Record.

4. Store the sampling utensil in a plastic bag until decontamination or disposal. Use a new or freshly-decontaminated sampling utensil for each sample taken.

5. Pack and ship as described in SOP F301.

6. Mark the location with a numbered stake if possible and locate sample points on a sketch of the site or on a sketch in the field logbook.

7. When a representative composited sample is to be prepared (e.g., samples taken from a gridded area or from several different depths), it is best to composite individual samples in the laboratory where they can be more precisely composited on a weight or volume basis. If this is not possible, the individual samples (all of equal volume, i.e., the sample bottles should be full) should be placed in a stainless steel bucket (or other appropriate container), mixed thoroughly using a decontaminated stainless steel spatula or trowel, and a composite sample collected. In some cases, as delineated in project-specific sampling and analysis plans, laboratory compositing of the samples may be more appropriate than field

compositing. Samples to be analyzed for parameters sensitive to volatilization should be composited and placed into the appropriate sample bottles immediately upon collection.

5.3 Rock Cores

Once rock coring has been completed and the core recovered, the rock core must be carefully removed from the barrel, placed in a core tray (previously labeled "top" and "bottom" to avoid confusion), classified, and measured for percentage of recovery, as well as the rock quality designation (RQD) (see SOP F101). If split-barrels are used, the core may be measured and classified in the split barrel after opening and then transferred to a core box.

Each core shall be described and classified on a Field Test Boring Record using a uniform system as presented in SOP F101. If moisture content will be determined or if it is desirable to prevent drying (e.g., to prevent shrinkage of hydrated formations) or oxidation of the core, the core must be wrapped in plastic sleeves immediately after logging. Each plastic sleeve shall be labeled with indelible ink. The boring number, run number and the footage represented in each sleeve shall be included, as well as the top and bottom of the core run.

After sampling, rock cores must be placed in the sequence of recovery in wooden or plastic core boxes provided by the drilling contractor. Rock cores from different borings shall not be placed in the same core box. The core boxes should be constructed to accommodate 10 to 20 linear feet of core and should be constructed with hinged tops secured with screws, and a latch (usually a hook and eye) to keep the top securely fastened. Wood partitions shall be placed at the end of each core run and between rows. The depth from the surface of the boring to the top and bottom of the drill run and the run number shall be marked on the wooden partitions with indelible ink. The order of placing cores shall be the same in all core boxes. The top of each core obtained should be clearly and permanently marked on each box. The width of each row must be compatible with the core diameter to prevent lateral movement of the core in the box. Similarly, any empty space in a row shall be filled with an appropriate filler material or spacers to prevent longitudinal movement of the core in the box.

The inside and outside of the core-box lid shall be marked by indelible ink to show all pertinent data pertaining to the box's contents. At a minimum, the following information must be included:

- Project name
- Date
- Boring number
- Footage (depths)
- Run number(s)
- Recovery
- Rock Quality Designation (RQD)
- Box number (x of x)

It is also useful to draw a large diagram of the core in the box, on the inside of the box top. This provides more room for elevations, run numbers, recoveries, comments, etc., than could be entered on the upper edges of partitions or spaces in the core box.

For easy retrieval when core boxes are stacked, the sides and ends of the box should also be labeled and include project name, boring number, top and bottom depths of core and box number.

Due to the weight of the core, a filled core box should always be handled by two people. Core boxes stored on site should be protected from the weather. The core boxes should be removed from the site in a careful manner as soon as possible. Exposure to extreme heat or cold should be avoided whenever possible. Arrangements should be made to dispose of or return the core samples to the client for completion of the project.

6.0 QUALITY ASSURANCE RECORDS

Where applicable, Field Test Boring Records and Test Boring Records will serve as the quality assurance records for subsurface soil samples, rock cores and near surface soil samples collected with a hand or power auger. Observations shall be recorded in the Field Logbook as described in SOP F303. Chain-of-Custody records shall be completed for samples collected for laboratory analysis as described in SOP F101 and SOP F302.

7.0 REFERENCES

1. American Society for Testing and Materials, 1987. Standard Method for Penetration Test and Split-Barrel Sampling of Soils. ASTM Method D1586-84, Annual Book of Standards, ASTM, Philadelphia, Pennsylvania.

2. American Society for Testing and Materials, 1987. Standard Practice for Thin-Walled Tube Sampling of Soils. Method D1587-83, Annual Book of Standards, ASTM, Philadelphia, Pennsylvania.

3. American Society for Testing and Materials, 1987. Standard Practice for Diamond Core Drilling for Site Investigation. Method D2113-83 (1987), Annual Book of Standards ASTM, Philadelphia, Pennsylvania.

4. U. S. EPA, 1991. Standard Operating Procedures and Quality Assurance Manual. Environmental Compliance Branch, U. S. EPA, Environmental Services Division, Athens, Georgia.

ATTACHMENT A

SUMMARY OF CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR AQUEOUS SAMPLES

Parameter	Bottle Requirements	Preservation Requirements	Holding Time [1]	Analytical Method	Bottle Volume
Volatile Organic Compounds (VOA)	glass teflon lined cap	Cool to 4°C 1:1 HCl pH <2	10 days	CLP	2 x 40 ml
Semivolatile Organic Compounds (SVOA)	glass teflon lined cap	Cool to 4°C Dark	Extraction within 5 days Analyze 40 days	CLP	2 x 1 liter
PCB/Pesticides	glass teflon lined cap	Cool to 4°C Dark	Extraction within 5 days Analyze 40 days	CLP	2 x 1 liter
Cyanide	plastic/glass	NaOH to pH>12 Cool to 4°C	14 days	CLP EPA 335.2	1 x 1 liter
Metals (TAL)	plastic/glass	HNO_3 to pH <2	180 days except Mercury is 26 days	CLP	1 x 1 liter
Total Organic Carbon	glass, teflon lined cap	Cool to 4°C H_2SO_4 to pH <2	28 days	EPA 415.1	2 x 40 ml
Total Organic Halogen	plastic/glass	Cool to 4°C H_2SO_4 to pH <2	28 days	EPA 450.1	250 ml
Chloride	plastic/glass	none required	28 days	EPA 325.2/325.3	250 ml
Sulfate	plastic/glass	Cool to 4°C	28 days	EPA 375.4	250 ml
Alkalinity	plastic/glass	Cool to 4°C	14 days	EPA 310.1/310.2	250 ml
Gross alpha/gross beta	plastic/glass	HNO_3 to pH <2	6 months	9310	1 gallon
Chlorinated herbicides	glass, teflon lined cap	Cool to 4°C	14/28 days	EPA 515.1	1000 ml
Hardness	plastic/glass	HNO_3 to pH <2	6 months	EPA 130.2	150 ml

(1) Holding times for CLP methods are based on Validated Time of Sample Receipt as stated in CLP statement of work of February, 1991. Holding times for Non-CLP methods are based on time of sample collection.

Note: Verify this information with the laboratory that will perform the analyses.

ATTACHMENT A (Continued)

SUMMARY OF CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR SOIL SAMPLES

Parameter	Bottle Requirements	Preservation Requirements	Holding Time [1]	Analytical Method	Bottle Volume
Volatile Organic Compounds (VOA)	glass teflon lined cap	Cool to 4°C	10 days	CLP	1 x 50 gm
Semivolatile Organic Compounds (SVOA)	glass teflon lined cap	Cool to 4°C	Extraction within 10 days Analyze 40 days	CLP	1 x 250 gm
PCB/Pesticides	glass teflon lined cap	Cool to 4°C	Extraction within 10 days Analyze 40 days	CLP	1 x 50 gm
Metals (TAL)	plastic/glass	Cool to 4°C	Mercury is 26 days 180 days	CLP	1 x 50 gm
Cyanide	plastic/glass	Cool to 4°C	14 days	CLP EPA 335.2M	1 x 50 gm

(1) Holding times for CLP methods are based on Validated Time of Sample Receipt as stated in CLP statement of work of February, 1991. Holding times for Non-CLP methods are based on time of sample collection.

Note: Verify this information with the laboratory that will perform the analyses.

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CHAIN-OF-CUSTODY

1.0 PURPOSE

The purpose of this SOP is to provide information on chain-of-custody procedures to be used to document sample handling.

2.0 SCOPE

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region-specific or site-specific requirements for chain-of-custody.

3.0 DEFINITIONS

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file. An example of a Chain-of-Custody Record Form is presented in Attachment B.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sampling Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

5.0 PROCEDURES

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, record keeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

5.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When in-situ measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s)
- Project and Task Number
- Project Sample Number
- Sample location or sampling station number
- Date and time of sample collection and/or measurement
- Field observations
- Equipment used to collect samples and measurements
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

5.1.1 Sample Label

Samples, other than in-situ measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project and Task Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 12/21/85).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 am., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site).

5.2 <u>Chain-of-Custody Procedures</u>

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed.

5.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.
- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once developed, the photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographs will be stored in the project files. It is good practice to identify sample locations in photographs by including an easily read sign with the appropriate sample/location number.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions, e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.

5.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. When transferring the possession of samples, the individual(s) relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below.

- Enter header information (Project and Task number, samplers, and project name).

- Enter sample specific information (sample number, media, sample analysis required and analytical method, grab or composite, number and type of sample containers, and date/time sample was collected).

- Sign, date, and enter the time under "Relinquished by" entry.

- Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).

- If a carrier is used, enter the airbill number under "Remarks," in the bottom right corner.

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample shipping package. Retain the copy with field records.

- Sign and date the custody seal, a 1- by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.

- Place the seal across the shipping container opening so that it would be broken if the container was to be opened.

- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

6.0 QUALITY ASSURANCE RECORDS

Once samples have been packaged and shipped, the COC copy and airbill receipt becomes part of the Quality Assurance Record.

7.0 REFERENCES

1. USEPA. User's Guide to the Contract Laboratory Program. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

ATTACHMENT A

EXAMPLE CLIENT (SAMPLE) LABEL

ATTACHMENT B

EXAMPLE CHAIN-OF-CUSTODY RECORD

ATTACHMENT C

EXAMPLE CUSTODY SEAL

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SOP Number: F303
FIELD LOGBOOK | **Effective Date: 04/94**

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FIELD LOGBOOK FIELD LOGBOOK

1.0 PURPOSE

This SOP describes the process for maintaining a field logbook.

2.0 SCOPE

The field logbook is a document which records all major on-site activities conducted during a field investigation. At a minimum, the following activities/events shall be recorded in the field logbook by each member of the field crew.

- Arrival/departure of site workers and visitors
- Arrival/departure of equipment
- Sample pickup (sample numbers, carrier, time)
- Sampling activities
- Start or completion of boreholes, monitoring wells, or sampling activities
- Health and safety issues

The field logbook is initiated upon arrival at the site for the start of the first on-site activity. Entries are made every day that on-site activities take place. At least one field logbook shall be maintained per site.

The field logbook becomes part of the permanent site file. Because information contained in the field logbook may be admitted as evidence in legal proceedings, it is critical that this document is properly maintained.

3.0 DEFINITIONS

Field logbook - The field logbook is a bound notebook with consecutively numbered pages. Upon entry of data, the logbook requires the signature of the responsible data/information recorder.

4.0 RESPONSIBILITIES

The Field Team Leader is responsible for maintaining a master field logbook for the duration of on-site activities. Each member of the sampling crew is responsible for maintaining a complete and accurate record of site activities for the duration of the crew members participation in the project.

5.0 PROCEDURES

The following sections present some of the information that must be recorded in the field logbook. In general, a record of all events and activities, as well as other potentially important information shall be recorded by each member of the field team.

5.1 Cover

The inside cover or title page of each field logbook shall contain the following information:

- Project and Task Number
- Project name and location
- Name of Field Team Leader
- Baker's address and telephone number
- Start date
- If several logbooks are required, a sequential field logbook number

It is good practice to list important phone numbers and points of contact here.

5.2 Daily Entries

Daily entries into the logbook may contain a variety of information. At the beginning of each day the following information must be recorded by each team member.

- Date
- Start time
- Weather
- All field personnel present
- All visitors present
- Other pertinent information (i.e., planned activities, schedule changes, expected visitors, and equipment changes)

During the day, an ongoing record of all site activities should be written in the logbook. The master logbook kept by the field team leader need not duplicate that recorded in other field logbooks, but should summarize the information in other books and, where appropriate, reference the page numbers of other logbooks where detailed information pertaining to a subject may be found.

Some specific information which must be recorded in the logbook includes the following:

- Equipment used, equipment numbers, calibration, field servicing
- Field measurements
- Sample numbers, media, bottle size, preservatives, collection methods, and time
- Test boring and monitoring well construction information, including boring/well number and location
- Sketches for each sample location including appropriate measurements if required
- Photograph log
- Drum log
- Other pertinent information

All entries should be made in indelible ink; all pages numbered consecutively; and all pages must be signed or initialed and dated by the responsible field personnel completing the log. No erasures are permitted. If an incorrect entry is made, the entry shall be crossed out with a single line, initialed, and dated.

5.3 Photographs

If photographs are permitted at the site, the record shall be maintained in the field logbook. When movies, slides or photographs are taken of any site location, they are numbered or cross-referenced to correspond to logbook entries. The name of the photographer, date, time, site location, site description, direction of view and weather conditions are entered in the logbook as the photographs are taken. Special lenses, film, or other image-enhancement techniques also must be noted in the field logbook. Once processed, photographs shall be serially numbered and labeled corresponding to the field logbook entries.

6.0 QUALITY ASSURANCE RECORDS

Once on-site activities have been completed, the field logbook shall be considered a quality assurance record.

7.0 REFERENCES

None.

STANDARD OPERATING PROCEDURE

QUALITY CONTROL SAMPLES

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QUALITY CONTROL SAMPLES

1.0 PURPOSE

The SOP describes the type and quantity of Quality Control (QC) samples to be collected for most field sampling operations.

2.0 SCOPE

QC samples are those samples (usually collected in the field) that are sent to the laboratory along with the environmental samples in order to evaluate site conditions and laboratory precision and accuracy. Evaluation of the results from the QC samples allows for the quality of the data to be assessed. There are five different type of QC samples: trip blanks, equipment rinsate blanks, field blanks, duplicates and matrix spike/matrix spike duplicate (MS/MSD) samples. The first three types of QC samples are used to assess field conditions during sampling and/or transport of the environmental samples. The latter two types of QC samples are used by the laboratory to help assess precision and accuracy. (The laboratory also has other internal samples and procedures to assess precision and accuracy.)

Depending on the Naval Energy and Environmental Support Activity (NEESA) Level of data quality required by the project, different amounts of QC samples are collected. These are described in detail below.

3.0 DEFINITIONS

Trip Blank - Trip blanks are 40-ml volatile organic analysis (VOA) vials of ASTM Type II water that are filled at the laboratory, transported to the sampling site, and returned to the laboratory with environmental VOA samples. Trip blanks are not opened in the field.

Equipment Rinsates - Equipment rinsates are samples of ASTM Type II water (provided by the laboratory) passed over decontaminated sampling equipment. They are used as a measure of the effectiveness of the decontamination procedure. The rinsate is analyzed for the same parameters as the environmental samples collected from the piece of equipment.

Field Blanks - Field blanks are samples of source water used for decontamination and steam cleaning. At a minimum there is one sample collected for each source of water used per sampling event. The field blank is analyzed for all the parameters tested during the sampling event.

Duplicates - Duplicates are collected to help assess laboratory reproducibility (precision). Solid matrix samples are homogenized before being split, except for VOAs, which are not homogenized because of potential volatile loss. Liquid matrix samples are collected simultaneously. For both solid and liquid matrices, double the normal volume is required. The same analyses are completed on the duplicate as on the environmental sample.

MS/MSD - MS/MSD samples are used by the laboratory (but collected in the field) to help determine both precision and accuracy of analysis. For liquid matrices, triple the volume of sample is required (that is, one volume for the environmental sample, one volume for the MS sample, and one volume for the MSD sample). For solid matrices, additional volume is usually not required (although this will depend upon the laboratory).

4.0 RESPONSIBILITIES

The Project Manager is responsible for estimating the number of QC samples required for any sampling event. The procedures for determining the number is described in Section 5.0 below. The Field Team Leader is responsible for making sure that the sampling team(s) are collecting the required number of QC samples. The Field Team member(s) are responsible for understanding the rationale and methods for QC sample collection and for coordinating QC sample collection as appropriate.

5.0 PROCEDURES

The procedures for QC sample collection and the frequency at which each type of sample should be collected is described below.

5.1 Trip Blanks

Trip blanks (one pair of 40 ml vials) are sent to the laboratory in each cooler which contains samples for volatile organic analyses. The trip blank should also be kept in the field, with the volatile samples, during the period of sample collection. Analyses of the trip blank will determine if the sample containers were contaminated prior to sampling or during transport.

5.2 Equipment Rinsates

Equipment rinsates are collected by pouring analyte-free water (provided by the laboratory) over decontaminated sampling equipment and collecting the rinsate. These are collected at a frequency of once per day and are analyzed for the same parameters as are the samples collected from that equipment. If two (or more) different types of equipment are used to collect samples in the same day (say by two field teams, one collecting soil samples from split spoons and one collecting groundwater from bailers), then two separate rinsate samples may be collected. The rinsate blank is used to qualify data.

5.3 Field Blanks

One field blank per source of water used for decontamination per sampling event is collected for all the parameters analyzed during that sampling event. In general, two field blanks are collected - one from the potable water source used for steam cleaning and one from distilled water purchased at a local store for use in general decontamination. The field blank is collected by opening up the water source at the sampling locations and pouring the water directly into the appropriate sample bottles. Analysis of the sample will indicate whether contamination was introduced into the samples during the collection process.

5.4 Duplicates

Field duplicates are collected at a frequency of 10 percent (one duplicate or per 10 samples) for levels C and D analyses, and at 5 percent (or one duplicate per 20 samples) for Level E analyses. The samples are split as described above and in other SOPs related to sample collection procedures. The number of duplicates to collect for levels C and D analyses is determined as follows: 1-10 environmental samples, 1 duplicate; 11-20 environmental samples, 2 duplicates; 21-30 environmental samples, 3 duplicates, etc. Field duplicates are primarily used to check the precision and consistency of the sampling procedures used and as a check of laboratory accuracy.

5.5 MS/MSD

MS/MSD samples are collected in the same manner as for a duplicate sample, except that triple the volume is required for analysis (for liquids). Generally no additional volume is required by the laboratory for solid samples (CHECK WITH THE LAB). The frequency of collection is one MS/MSD pair (or two additional sample volumes) for each 20 environmental samples collected of similar matrix (e.g. groundwater, surface water, soil). The number of MS/MSD samples to collect is determined as follows: 1-20 environmental samples, one MS/MSD pair; 21-40 environmental samples, two MS/MSD pairs, etc. NEESA requires that one field duplicate be collected at the same location as the MS/MSD pair.

6.0 SAMPLE COLLECTION RECORDS AND EVALUATION

Records of collection of QC samples are kept in the field logbooks and on the Chain-of-Custody forms. Evaluation of the results from the QC samples is performed by the laboratory and through data validation for the MS/MSD samples. Results of the other QC samples are compared to analytical results from the sampling event to determine if any field procedures, or sample transportation/handling may have adversely affected the concentrations found in the environmental samples.

7.0 REFERENCES

Hazardous Waste Remedial Actions Program, 1990. Requirements for Quality Control of Analytical Data. DOE/HWP-65/R1, US Department of Energy, Oak Ridge, Tennessee.

Naval Energy and Environmental Support Activity, 1998. Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program. NEESA 20.2-047B, Port Hueneme, California.

USEPA, 1988. User's Guide to the Contract Laboratory Program. 9240.0-1, Office of Emergency and Remedial Response, Washington, D.C.

USEPA, 1990. Quality Assurance/Quality Control Guidance for Removal Activities - Sampling QA/QC Plan and Data Validation Procedures (Interim Final). EPA/540/G-90/004, Office of Emergency and Remedial Response, Washington, D.C.

FIELD EQUIPMENT OPERATION AND MAINTENANCE PROCEDURES - DECONTAMINATION OF SAMPLING AND MONITORING EQUIPMENT

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SOP Number: F502
Effective Date: 1993

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DECONTAMINATION OF SAMPLING AND MONITORING EQUIPMENT

1.0 PURPOSE

The purpose of this SOP is to provide a general methodology and protocol, and to reference information for the proper decontamination of field chemical sampling and analytical equipment.

2.0 SCOPE

This procedure applies to all field sampling equipment including, but not limited to, split-barrel soil samplers (split-spoons), direct push samplers, bailers, beakers, trowels, filtering apparatus, and pumps. This procedure should be consulted when decontamination procedures are being developed as part of project-specific plans. Additionally, current USEPA regional procedures and decontamination guidance as well as state guidance should be reviewed.

3.0 DEFINITIONS

Decontamination - Decontamination is the process of removing or neutralizing contaminants which may have accumulated on field equipment. This process ensures protection of personnel from penetrating substances, reduces or eliminates transfer of contaminants to clean areas, prevents mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

4.0 RESPONSIBILITIES

Project Manager - It is the responsibility of the Project Manager to ensure that project-specific plans are in accordance with these procedures. Documentation should be developed for areas where project plans deviate from these procedures.

Field Team Leader - It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field. The Field Team Leader is responsible for ensuring field personnel performing decontamination activities have been briefed and trained to execute these procedures.

Sampling Personnel - It is the responsibility of field sampling personnel to follow these procedures, or to follow documented, project-specific procedures as directed by the Field Team Leader.

5.0 PROCEDURES

In order to ensure that chemical analysis results reflect actual concentrations present at sampling locations, sampling equipment must be properly decontaminated prior to the field effort, during the sampling program (i.e., between sampling locations) and at the conclusion of the sampling program. This will minimize the potential for cross-contamination between sampling locations and the transfer of contamination off site.

Preferably, sampling equipment should be dedicated to a given sampling location. If this is not possible, equipment must be decontaminated between sampling locations. Sampling personnel must use disposable gloves and change them between sampling locations.

5.1 Sampling Equipment Decontamination Procedures

Soil and sediment sampling equipment including, but not limited to trowels, beakers, dredges, etc., shall be decontaminated using the following USEPA procedures.

USEPA

Prior to use, all sampling equipment should be carefully cleaned using the following procedure:

1. Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.

2. Rinse thoroughly with tap water.

3. Rinse with 10 percent nitric acid rinse

4. Rinse thoroughly with distilled-deionized water and allow to air dry.

5. Rinse with methanol or hexane and allow to air dry.

6. Rinse thoroughly with distilled-deionized water and allow to air dry.

7. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.

* Portable power augers (such as the Little Beaver®) or large soil boring/drill rigs should be cleaned before boring or drilling operations.

* For badly contaminated equipment, a hot water detergent wash may be needed prior to the rinse procedure.

* If the samples will not be analyzed for metals, then steps 3 and 4 may be omitted; if samples will not be analyzed for organics, then step 5 may be omitted. All solvents must be pesticide-grade.

5.2 Field Analytical Equipment Decontamination

Field analytical equipment which may come in direct contact with the sample or sample media, including, but not limited to water level meters, water/product level meters, pH or specific ion probes, specific conductivity probes, thermometers, and/or borehole geophysical probes must be decontaminated before and after use, according to the procedures outlined in Section 5.1, unless manufacturers instructions indicate otherwise. Probes that contact water samples not used for laboratory analyses may be rinsed with distilled water. Probes which make no direct contact (e.g. HNu or OVA probes) will be wiped clean with clean paper towels or an alcohol-saturated cloth.

6.0 QUALITY ASSURANCE RECORDS

Decontamination procedures are monitored through the collection of equipment rinsate samples and field blanks. Collection of these samples shall be specified in the project-specific Sampling and Analysis and Quality Assurance Plans. Documentation recorded in the field logbook also shall serve as a quality assurance record.

7.0 REFERENCES

U. S. EPA Office of Waste Program Enforcement, 1986. RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD). OSWER Directive 9950.1.

U. S. EPA, 1991. Standard Operating Procedures and Quality Assurance Manual. Environmental Compliance Branch, U. S. EPA Environmental Services Division, Athens, Georgia.

Micham, J. T., R. Bellandi, E. C. Tifft, Jr., Spring 1989. "Equipment Decontamination Procedures for Ground Water and Vadose Zone Monitoring Programs: Status and Prospects." in Ground Water Monitoring Review.

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SOP Number: F504

HANDLING OF SITE INVESTIGATION DERIVED WASTES **Effective Date: 1993**

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HANDLING OF SITE INVESTIGATION DERIVED WASTES

1.0 PURPOSE

The purpose of this SOP is to provide guidance for the disposal of investigation derived wastes (IDW) generated under a field investigation program.

2.0 SCOPE

This procedure describes the steps necessary to dispose of site investigation derived wastes that are generated during field investigations. These wastes may be either hazardous or nonhazardous in nature. The nature of the waste (hazardous or nonhazardous) will determine how the wastes will be handled during the field investigation. The sources of waste material depend on the site activities planned for a project. The following types of activities (or sources) that are typical of site investigations, may result in the generation of waste material which must be properly handled:

- Soil borings and monitoring well construction (drill cuttings)
- Mud rotary drilling (potentially contaminated mud)
- Monitoring well development (development water)
- Groundwater sampling (purge water)
- Heavy equipment decontamination (decontamination fluids)
- Sampling equipment decontamination (decontamination fluids)
- Personal protective equipment [PPE] (health and safety disposables)

3.0 DEFINITIONS

Investigation Derived Waste (IDW) - A waste (hazardous or nonhazardous) generated during a field investigative task that has been properly labeled, stored, and containerized while awaiting final disposition. These wastes may include drilling muds, soil cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues (e.g., ash, spent-carbon, well development purge water) from testing of treatment technologies and pump and treat systems; contaminated PPE; and solutions used to decontaminate non-disposable PPE and equipment (USEPA, April 1992, Guide to Management of Investigation-Derived Wastes).

4.0 RESPONSIBILITIES

Client - The Client must ultimately be responsible for the final disposition of site wastes. As such, a facility representative will usually prepare and sign waste disposal manifests as the generator of the material, in the event off-site disposal is required. However, it may be the responsibility of Baker, depending on the contingency discussions during execution of the investigation to provide assistance to the Client in arranging for final disposition and preparing the manifests.

Project Manager - It is the responsibility of the Project Manager to select investigation methods that minimize the generation of waste material, where possible, and to work with the Client in determining the final disposition of site investigation wastes. The Project Manager will relay the results and implications of the chemical analysis of the waste or associated material, and advise on the regulatory requirements and prudent measures appropriate to the disposition of the material. The Project Manager also is responsible for ensuring that the site manager and/or field team leader for the site, is familiar with the procedures to be implemented in the field, and that all required field documentation has been completed.

Site Manager/Field Team Leader - The Site Manager or Field Team Leader is responsible for the on site supervision of the waste handling procedures during the site investigations. The Site Manager or Field Team Leader also is responsible for ensuring that all other field personnel are familiar with these procedures.

5.0 PROCEDURES

5.1 Preliminary Activities

Prior to the initiation of site activities the expected sources, media, and method(s) of containerizing and staging of these materials will be identified.

5.2 Designation of Potentially Hazardous and Nonhazardous IDW

Wastes generated during the field investigation can be categorized as either potentially hazardous or nonhazardous in nature. The designation of such wastes will determine how the wastes will be handled. The criteria for determining the nature of the waste, and the subsequent handling, is described below for each type of investigative waste.

5.2.1 Drill Cuttings/Mud

Drill cuttings and mud generated during the augering of test (soil) borings and monitoring well installation boreholes, will be containerized in 55-gallon drums or in lined roll-off boxes. As the borehole is augered, and soil samples collected, the site geologist will monitor the cuttings/samples with an HNu photoionization (PID) unit for organic vapors. In addition, the site geologist will describe the soils in a field logbook. Upon completion, the soil borings will be backfilled with a cement-bentonite grout.

5.2.2 Monitoring Well Development and Purge Water

All site development and purge water shall be containerized in 55-gallon drums, tankers, or large (250-gallon) containers. 55-gallon drums will initially be strategically located at the site (i.e., next to each well).

5.2.3 Decontamination Fluids

Equipment and personal decontamination fluids shall be containerized in 55-gallon drums or tanks, if appropriate. The fluids shall be collected from each of the "decon"/wash pads on a daily basis. Decontamination fluids containing solvents and/or acids may be containerized separately.

5.2.4 Personal Protective Equipment

All personal protective equipment (e.g., tyvek, gloves, and other health and safety disposables) shall be double bagged and placed in a 55-gallon drum or a dump box, which will be either arranged by Baker or provided by the Client. The Client assisted by Baker will ultimately dispose of these materials.

5.3 Containerization

Waste materials should be segregated to minimize disposal quantities of hazardous materials. For instance, soils from a particular boring will be placed in a single set of containers for that boring. Development and purge water from a given well may be placed in the same set of containers; however, water from different wells should be placed in different containers unless otherwise stipulated by the Project Plans.

Polyethylene or other suitably compatible liners will be used in roll-off boxes for solids. The containers are to remain closed except when filling, emptying or sampling. The container lid shall be securely attached at the end of each work day or when the container is completely empty.

5.4 Labeling

When 55-gallon drums are used to containerize IDWs, the containers will be closed, numbered and labeled by the field team during the site investigation. Information shall be recorded both on the container lid and its side. Container labels shall include, as a minimum:

- Date
- Site number
- Project number
- Boring or well number
- Matrix (liquid, solid)
- Contents (dev. water, decon fluids, etc.)
- Contaminant of concern (PCBs, solvents, metals, etc.)

If laboratory analysis reveals that containerized materials are hazardous or contain PCBs, additional labeling of containers may be required. The project management will assist the Client in additional labeling procedures, if necessary, after departure of the field team from the facility. These additional labeling procedures will be based upon the identification of material present; EPA regulations applicable to labeling hazardous and PCB wastes are contained in 40 CFR Parts 261, 262 and 761.

5.5 Container Storage

Containers of site investigation wastes shall be stored in a designated and secure area that is managed by the client until disposition is determined.

If the laboratory analysis reveals that the containers hold hazardous or PCB waste, additional storage and/or security measures may be implemented; in the absence of the investigation team, this will be the responsibility of Client assisted by Baker.

Baker will assist the Client in devising the storage requirements, which may include the drums being staged for easy access or on wooden pallets or other structures to prevent contact with the ground. Weekly inspections of the temporary storage area by facility personnel may also be required. These inspections may assess the structural integrity of the containers and proper container labeling. Also, precipitation that may accumulate in the storage area may need to be removed. These weekly inspections and precipitation removal events, shall be recorded in the site logbook.

5.6 Container Disposition

The disposition of containers of site investigation generated wastes shall be determined by the Client and regulatory personnel with the assistance of Baker, as necessary. Disposition of the containerized waste shall be based on quantity, types of material, and analytical results. If necessary, samples of the containerized waste may be collected for waste characterization purposes. Disposition will not be addressed until after receipt of applicable analytical results; these results are usually not available until long after completion of the field investigation at the facility.

5.7 Disposal of Contaminated Materials

Actual disposal methods for contaminated materials disturbed during a site investigation are the same as for other PCB or hazardous substances: incineration, landfilling, treatment, and so forth. The responsibility for disposal must be determined and agreed upon by all involved parties during negotiations addressing this contingency.

The usual course will be a contractor specialist retained to conduct the disposal. However, regardless of the mechanism used, all applicable Federal, state and local regulations shall be observed. EPA regulations applicable to generating, storing and transporting PCB or hazardous wastes are contained in 40 CFR Parts 262, 263 and 761.

Another consideration in selecting the method of disposal of contaminated materials is whether the disposal can be incorporated into subsequent site cleanup activities. For example, if construction of a suitable on-site disposal or treatment structure is expected, contaminated materials generated during the site investigation may be stored at the site for treatment/disposal with other site materials. In this case, the initial containment (i.e., drums or other containers) shall be evaluated for use as long-term storage. Also, other site conditions, such as drainage control, security and soil types must be considered in order to provide proper storage.

6.0 QUALITY ASSURANCE RECORDS

A container log shall be maintained in the site log book. The container log shall contain the same information as the container label plus any additional remarks or information. Such additional information may include the identification number of a representative laboratory sample. Weekly inspections of the drum or dump box storage areas will be performed and documented in the site log.

7.0 REFERENCES

40 CFR Parts 261, 262, 263 and 761.

ATTACHMENT B
QUALITY ASSURANCE PROJECT PLAN ADDENDUM

Final

QUALITY ASSURANCE PROJECT PLAN
LIVE IMPACT AREA
VIEQUES ISLAND, PUERTO RICO

CONTRACT TASK ORDER 0397

JULY 24, 2000

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Carpools, Pennsylvania

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the organization, objectives, functional activities, and specific quality assurance/quality control (QA/QC) activities associated with surface soil sampling within the live impact area (LIA) on Vieques Island, Puerto Rico. It contains information concerning sampling descriptions and rationale and data quality objectives (DQOs). As noted in the Work Plan, this sampling and analysis program is designed to support an analysis used by the Agency for Toxic Studies and Disease Registry (ATSDR) tasked to perform a human health assessment of the area. A secondary objective is to collect physical soil characteristics to support an air model.

The field activities include the collection of equipment blanks, field blanks, surface soil samples, and duplicate surface soil samples. The samples will be analyzed for parameters listed in Table 3-2 of the Work Plan.

2.0 PROJECT DESCRIPTION

The Live Impact Area (LIA) is used to train military personnel in air-to-ground strikes and naval gunfire support. Training is conducted with practice and live rounds.

2.1 Overall Project Objectives

The objective of this task order is to collect surface soil samples to support ATSDR. A secondary objective is to collect physical soil characteristics to support an existing Navy air model.

2.1.1 Task 1 – Sampling Plans and QAPP

A Sampling and Analysis Plan has been prepared for this effort. This QAPP is incorporated into the sampling plan by reference.

2.1.2 Task 2 – Sampling

The sampling at the LIA will be performed in accordance with USEPA Region II guidelines. Quality Assurance/Quality Control (QA/QC) samples will be collected. These will include QA/QC samples pertinent to fieldwork such as equipment blanks, field blanks, primary samples, and duplicate samples.

Samples taken in the vicinity of target areas will be tested for explosives using Ensys test kits prior to shipment. Samples containing more than 10 percent explosives will be addressed as high-hazard samples and handled accordingly.

After the samples are collected, they will be shipped to the U.S. laboratories (having appropriate USDA approval to receive soils from outside the U.S.) using an overnight courier for delivery.

2.2 QAPP Preparation Guidelines

All QA/QC procedures described herein are structured in accordance with applicable USEPA requirements, regulations, guidelines, and technical standards.

2.3 Project Schedule

Samples are to be collected as soon as logistically possible. Sampling should be completed within one to three days. Full data packages are anticipated to be available 30 days from the receipt of samples by the laboratory. Data validation is anticipated to be a two-week effort, following receipt of the complete data packages. A technical report will be prepared and presented to the Navy.

3.0 CHEMICAL DATA QUALITY OBJECTIVES

3.1 Data Uses

For each site designated for environmental sampling, the following Data Quality Objectives (DQOs) have been identified:

- Assess the presence or absence of explosives and metals to support ATSDR. The laboratory will use state-of-the-art methodology and instrumentation (i.e., ICP-MS) for meeting the desired quantitation limits as provided on Table 5-1.

- Collect physical soil characteristics to support an air model.

- Assess soil sample characteristics for Department of Defense shipping purposes.

3.2 Data Quality Needs

DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions made during the investigation. The DQOs are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. To assist in the interpretation of data, the following two descriptive data categories are used:

- **Screening Data with Definitive Confirmation**

  Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Screening data provide analyte identification and quantification, although quantification may be relatively imprecise. Screening data without associated confirmation data are not considered to be data of known quality. Screening data for this project (data generated on-site) include temperature, pH, and dissolved oxygen.

- **Definitive Data**

  Definitive data are generated using rigorous analytical methods such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, and digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

3.3 Method Specific Data Quality Objectives

Precision, accuracy, representativeness, completeness, and comparability goals for this project are described below. These data quality parameters are expressed as goals due to uncertainties regarding field conditions and the complexity of the sample matrices at the site. The ability of the laboratory to extract and quantify the target analytes is highly dependent on matrix complexity. Great care must be taken both in the field and at the laboratory to generate representative results. The variability of soil conditions also may affect the data representativeness and comparability.

3.3.1 Precision and Accuracy

Precision is a measure of the reproducibility of measurements under a given set of conditions. Accuracy is a measure of the bias that exists in a measurement system.

Field duplicates are collected and analyzed to assess field sampling activities. The results determine ambient conditions (precision) at the site.

Inorganic precision and accuracy data are determined by using duplicate samples (precision), matrix spike, and laboratory control samples (accuracy). The following procedure is used:

Typically, for a duplicate sample analysis, at least one duplicate sample is analyzed per sample matrix type (e.g., water, soil) per batch of samples or one per 10 samples received, whichever is more frequent. It is estimated that three batches of samples (one per day) will be generated; therefore, three field duplicates will be generated. Samples identified as field blanks cannot be used for duplicate sample analysis. If two analytical methods are used to obtain the reported values for the same element for a batch of samples (i.e., ICP, GFAA), duplicate samples will be run by each method. The relative percent difference (RPD) for each component is calculated for later use during data assessment.

When applicable, control limits established by SW-846 are used to judge acceptability of data generated by the laboratory. Where EPA acceptability criteria does not exist, the laboratory will use control limits derived in-house through the use of control charts. Control limits will not automatically initiate reanalysis if they are not met; corrective action will be based on method requirements.

3.3.2 Representativeness

Representativeness is a qualitative element that is related to the ability to collect a sample that reflects the characteristics of that part of the environment that is to be assessed. Specific representativeness statistical goals are established because co-located samples are an integral element of this project. Sample representativeness is dependent on the sampling techniques used and is considered individually for each project. Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the sample. Sample handling protocols (e.g., storage, preservation and transportation) have been developed to preserve the representativeness of the samples. Proper documentation will establish that protocols have been followed and sample identification and integrity assured. Every attempt will be made to ensure that the aliquots taken for analysis are representative of the samples received.

3.3.3 Completeness

Completeness is defined as the amount of valid data obtained from the laboratory compared with the amount of data that would be expected under normal conditions. Data are considered to be valid if they are unqualified or if they are qualified as estimated with a J code. The laboratory qualifies data based on its internal SOPs. The data validator will review all laboratory qualifiers during review of the entire data package. The laboratory data completeness will be 95 percent or better.

3.3.4 Comparability

Data generated needs to be comparable to established regulatory values and to previous sampling that has been performed at the identified locations. Comparability is achieved by using standard methods to collect and analyze samples and by reporting analytical results in appropriate units. Sample collection, preparation, cleanup (if necessary), analytical, and reporting procedures/methods will be consistent, per matrix/batch, for each analytical group for the duration of the project. Quantitation level requirements to be used for the analytical results are presented on Table 5-1 found in Section 5.0, Laboratory Analytical Procedures.

4.0 PROJECT ORGANIZATION AND QC RESPONSIBILITY

4.1 Overview

The Baker project management organization is designed to provide a line of functional responsibility and authority supported by a management control structure and independent quality assurance review. This control structure provides for:

- Clearly identified lines of communication and coordination;
- Project budget and schedule monitoring;
- Key technical resources management;
- Financial management and progress reports; and
- Quality Control.

4.2 Organization Chart

An organization chart, which identifies the functional roles and interrelationships of key project participants is presented on Figure 4-1. In the following sections, the responsibilities of key project team members, relative to the overall QA/QC objectives of the project, are identified. Information regarding the laboratories and data validator selected to perform the chemical analyses is also provided.

4.3 Project Responsibilities

4.3.1 Navy Technical Representative

The Navy Technical Representative (NTR) has the overall responsibility for this study. The NTR for the field sampling activities is Ms. Sherri Eng. All coordination of project activities and technical issues will be managed by the NTR.

4.3.2 LANTDIV QA Manager

During the performance of field activities and data generation, LANTDIV may, at their option, provide a QA Manager who will remain independent of direct job involvement and day-to-day operations and have direct access to the LANTDIV Project Manager and LANTDIV Technical Manager, as necessary, to resolve any QA dispute. The QA Manager may conduct audits during field activities to ensure the QA program is being implemented in conformance with the project work plans and LANTDIV requirements.

4.3.3 Baker Project Management

Mr. Kenneth Martin is the PM for Baker, the primary contractor for the field sampling and data analysis efforts. Mr. Martin is responsible for coordinating the project quality control, interaction with LANTDIV, project budget, scheduling, data interpretation, and subcontractor's duties. He shall have the authority to commit the resources necessary to meet the project objectives and requirements. The Baker project manager shall report directly to both the LANTDIV PM and the LANTDIV Technical Manager and will be the major point of contact and control for all project related matters.

4.3.4 Overall QA Officer

The Baker QA Officer is responsible for ongoing surveillance of project activities to help ensure conformance with this QAPP to evaluate the effectiveness of its requirements. The QA Officer has access to all personnel and subcontractors, as necessary, to resolve quality problems and has the authority to stop field activities if major deficiencies in quality occur. The Baker QA Officer will be responsible for ensuring that all applicable procedures for this project are being followed. The Overall QA Coordinator will be responsible for ensuring a full data validation, in accordance with procedures stated in USEPA guidance documents, on 100 percent of the analyses performed for the project. Mr. Richard Hoff has been assigned as the Overall QA Officer for this project.

4.3.5 Sampling Coordinator (Field QA Coordinator)

The field sampling effort for this project will be conducted by Baker. The Sampling Coordinator (Field QA Coordinator) will be the primary technical point of contact for the field team on data quality issues, and will be responsible for overall coordination of on-site clean and conventional field sampling activities. Additionally, the Sampling Coordinator will be responsible for decisions regarding any necessary modifications the SAPs and overseeing LANTDIV, Puerto Rico, and/or USEPA approvals and implementation of any such changes. Mr. Kenneth Martin has been assigned as the Sampling Coordinator for the project.

4.3.6 GPS Operator

A GPS operator will accompany the field sampling team to the various sampling sites to measure and record the coordinates at which each sample was taken. The GPS operator will also assist in the sampling, as necessary.

4.3.7 Laboratory QA Coordinators

The laboratory has assigned a QA Coordinator who will be the primary technical point of contact on data quality issues and will be responsible for coordination of chemical analyses. Additionally, the Laboratory QA Coordinator will be responsible for the initial data review of all sample results from the analytical laboratory. Laboratory QA Coordinator for this project will be determined after procurement of the laboratory.

4.3.8 Laboratory Sampling and Analysis Teams

The laboratory will utilize a team of chemists to perform the required analyses and associated quality control evaluations.

4.4 Data Validation

Data validation will be performed in accordance with EPA guidance. This work will be performed by a Baker subcontractor on 100 percent of the analyses.

A detailed and independent data validation will be performed by a data validation subcontractor to verify the qualitative and quantitative reliability of the data presented and adherence to stated analytical protocols. This review will include a detailed review and interpretation of all data generated for organic and inorganic analyses by the laboratory for Level IV deliverables. During validation, the sample holding times, initial and continuing instrument calibrations, blank analyses (equipment blanks, field blanks, and method blanks), matrix spike/matrix spike duplicate (MS/MSD) analyses, laboratory control sample (LCS) analyses, duplicate analyses (laboratory and field), and internal standard performance will be evaluated. The primary tools which will be used by experienced data validation personnel will be analytical method operating practices, statements of work (for CLP), guidance documents, established criteria, and professional judgement.

During the data review, a data support documentation package will be prepared which will provide the back-up information that will accompany all qualifying statements present in the quality assurance review.

5.0 LABORATORY ANALYTICAL PROCEDURES

5.1 Introduction

This project will include the analysis of surface soil samples for the following chemical groups/fractions:

- Inorgranics
  - Antimony
  - Arsenic
  - Barium
  - Beryllium
  - Cadmium
  - Chromium (Total)
  - Cobalt
  - Copper
  - Cyanide
  - Lead
  - Mercury
  - Nickel
  - Selenium
  - Silver
  - Sulfide
  - Thallium
  - Tin
  - Vanadium
  - Zinc

- Nitramine/Nitroaromatic Compounds
- Picric Acid
- Ammonium Perchlorate

In addition, select surface soil samples will be analyzed for the following engineering paramenters:

- Grain size (sieve/hydrometer)
- Bulk Density
- Moisture Content

Target quantitation limits and analytical methods are presented in Table 5-1. Descriptions of the internal quality control checks performed by the laboratories are provided below.

5.2 Laboratory QC Samples

5.2.1 Laboratory Method Blank

A method blank will be prepared and analyzed with each batch of 20 or fewer samples. The samples for this project will be batched together. If analytes are detected above the quantitation limits listed on Table 5-1, preparation and analysis will be stopped and the source of contamination found, documented, and eliminated. All samples following the last contaminant-free method blank that contained the contaminant will be re-prepared and re-analyzed.

5.2.2 Matrix Spike/Matrix Spike Duplicates - Inorganic

If the spike recovery results exceed the limits set in accordance with laboratory SOPs, the respective sample result will be qualified. For example, if the spike recovery result for an analyte is below the value derived by the laboratory, but above a certain percentage (calculated by each laboratory in accordance with their internal SOPs), the result will be qualified as estimated with a "J" code. If the spike recovery result for an analyte is less than the laboratory calculated percentage and the respective sample result is reported as not detected at (or less than) the practical quantitation limit, the associated samples will be qualified as unusable.

In instances where the sample concentration exceeds the spike concentration by a factor of four or more, the limits will not apply. However, no more than a laboratory calculated percentage (based on individual SOPs) of all spike recovery data reported for a given analyte may be reported where the sample concentration exceeds the spike concentration by a factor of four or more. If the frequency exceeds this percentage, the matrix spike and matrix spike duplicate samples will be re-prepared at a higher spike concentration.

5.2.3 Laboratory Control Samples

Laboratory Control Samples (LCS) are samples which have been prepared in a matrix similar to that of the field samples and which have been spiked with known concentrations of analytes. The LCS standard is prepared independently of calibration standards to provide a check on instrument calibration. The LCS is prepared and analyzed by the same methods as the field sample. The percent recovery of the analytes in the LCS indicates if the analytical method is in control. If the control limits are exceeded, the LCS and all field samples extracted/analyzed with that batch must be re-extracted and reanalyzed unless otherwise approved.

5.3 Field QA/QC Samples

Field QC duplicates are samples taken in the field at the same time and in the same manner as the original sample for the purpose of verifying the sampling technique. Field duplicates are compared using the following RPD calculation:

$$RPD = \frac{(D1-D2)}{(D1+D2/2)} \times 100$$

6.0 SAMPLING PROCEDURES

Sample containers and preservatives will be obtained directly from the analytical laboratory subcontractor. The laboratory will certify all sample containers as clean and a certificate of analysis will be supplied with each lot ordered. These certificates will be kept on file by the laboratory and a record of the bottle lot numbers and preservatives used in the field will be made in the field sampling log; bottle lots and preservatives will be traceable to the field sample numbers. Sample containers to be used are listed in the project SAP and are grouped by analytes and matrix.

7.0 PREVENTATIVE MAINTENANCE PROCEDURES

A routine preventative maintenance program is conducted by the laboratory to minimize the occurrence of instrument failure and other system malfunctions. Section supervisors and/or analysts (organic, inorganic) perform routine scheduled maintenance, and coordinate with the vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturers maintenance is provided under a repair and maintenance contract with factory representatives. All preventative maintenance will be performed in accordance with the specific laboratory Quality Assurance Plan.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 <u>Laboratory Instruments</u>

Laboratory calibration procedures and frequency will be done in accordance with the methods listed on Table 5-1. Documentation of calibration and maintenance is kept in bound notebooks. If equipment has been out of service for two weeks or longer, the equipment will be recalibrated immediately prior to use and then at the frequencies prescribed below to ensure acceptable continual calibration while in use. Calibration procedures for the laboratory are summarized in the paragraphs that follow.

8.1.1 Metals

For each analyte of interest, a calibration curve is prepared which covers the linear working range of the method. For mercury analyses, a minimum of three concentration levels and a blank are used to construct the calibration curve, including one near the upper limit of the concentration range and one near the lower limit of the concentration range with an equitable distribution of the remaining points. For the ICP-MS analysis, the calibration curve consists of one standard and a blank. Instrument detection limits and linear range is established quarterly. All metals calibrations will be performed based on the analytical method and the subcontracted laboratory's SOP.

The linear regression technique is used to find a straight line that best fits a set of calibration points. For a calibration curve to be acceptable, the correlation coefficient must be greater than or equal to 0.995, and the difference between the value observed for an independent standard and the value predicted for that standard using the fitted calibration curve must be within ten percent.

A calibration verification check sample and calibration blank are analyzed after every ten samples and at the end of the analyses for the day. Recalibration of the ICP is performed if the ten-percent limit is exceeded, and the ten samples preceding the out-of control check standard and blank are reanalyzed. Recalibration for mercury is performed if the 20 percent limit is exceeded.

8.1.2 Other Analyses

Calibration will be performed using standard laboratory protocols. Documentation of calibration in the final data reports will be required.

9.0 CORRECTIVE ACTION

A corrective action protocol that is both technically effective and administratively compatible to ensure accurate and timely correction of non-conformance is imperative. The sections that follow describe the corrective action plan for this project.

9.1 Field Procedures

For the field activities, the Field Team Leader is responsible for all site activities. In this role, he/she may be required to adjust the field program to accommodate site-specific needs. If it becomes necessary to modify the program, then he/she will consult the Baker and the NTR regarding an appropriate corrective action. Agreed upon corrective actions for the program will be documented in the field notes. Changes may include deleting a sampling location or modifying a documented sampling protocol to better ensure the quality assurance/quality control for the project.

Work may be stopped by the Sampling Coordinator if corrective actions to significant problems are insufficient, the problem remains unresolved or if results or prior work are indeterminate.

9.2 Laboratory Procedures

Nonconformance is any event that is beyond the limits established for laboratory performance such as data which fall outside accepted bounds for accuracy and precision, due to improper equipment calibration/maintenance or improper data verification. Any activity in the laboratory that affects data quality can result in a nonconformance.

Nonconformances associated with the statistical analysis and review of data are straightforward to identify. The Laboratory QA Coordinator will be responsible for the assessment of QC sample information. The Baker PM and the NTR will be notified of any non-conformances.

Corrective actions will be designed to correct the associated problems and to minimize the possibility of their recurrence. Examples of corrective actions are modifying non-conforming procedures; tagging, repairing, or replacing deficient equipment; training or replacing unqualified personnel; re-analyzing affected samples; marking rejected data, and reissuing affected reports.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 Data Reduction

Upon completion of the analysis, the analyst calculates the final sample and associated QC results from the raw data. Additionally, for organic analyses, the analyst will review the scans of each sample and standard on the instrument terminal. The analyst will check for recovery of surrogate compounds, sample response within the linear range of the calibration curve, and the integration of peaks. Peaks that appear suspect may be re-integrated by the analyst.

10.2 Analytical Data Package Requirements

The data will be submitted to Baker in both hard copy and on disk. All data packages will be CLP-type in that all the information required for the CLP will be provided. For each analytical method run, the laboratory will report all required analytes for each sample as a detected concentration or as non-detected value. Detections below the TQL will be reported to the MDL and qualified as appropriate. In addition, applicable method detection limits and instrument detection limits will be required for every analysis. Each analytical method run will be clearly identified as belonging to a specific analytical batch. All samples must be reported with dates of collection, preparation and analysis. The laboratory will also report dilution factors for each sample.

A complete set of quality control results, including calibration data, will be reported for each analytical batch. All required method QC will be performed on project samples. The quality control samples required and their frequency are identified in Section 5.0. A 60-calendar day turnaround time (for complete data packages) from sample receipt at the laboratory to data receipt will be needed for all samples. Raw data should be made available to Baker within 15 days of sample receipt. The laboratories will hold and make available all project raw data for a minimum period of three years after samples have been analyzed.

10.2.1 Method Blanks

All analytes will be reported for each laboratory blank. All sample results will be designated as corresponding to a particular laboratory blank in terms of analytical batch processing.

10.2.2 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike recoveries and RPDs will be reported for the samples. All general sample results will be designated as corresponding to a particular MS/MSD pair. The report will indicate what field sample was spiked; MS/MSDs will be performed on project samples. The control limits for the matrix spike recoveries and RPD criteria are laboratory specific and will be included in the data package.

10.2.3 Laboratory Control Samples

The laboratory control results will be reported for all analyses. All sample results will be designated as corresponding to a particular LCS sample in terms of analytical batch processing. Control limits will be included in the data package.

10.2.4 Other Method Quality Control

Additional quality control checks, such as method of standard additions and serial dilutions for the analysis of metals, analytical spikes for metals, initial and continuing calibration data for all analytes, internal standard areas, and tunes will be reported. Control limit ranges for all QA/QC samples will also be reported.

10.3 Data Validation

The QA Coordinator will coordinate a subcontracted review of the QC results for 100 percent of the data. Analytical results will be validated using the approach described in the Section 2.6 of the Work Plan.

TABLES

TABLE 5-1

ANALYTICAL METHODS
LIVE IMPACT AREA
VIEQUES ISLAND, PUERTO RICO

Constituent	Quantitation Limits[a] Water (µg/L)	Soil (µg/kg)	Method Number
Nitramine/Nitroaromatic Compounds:			
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetroazocine (HMX)	0.625	1250	8330
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.625	1250	8330
1,3,5-Trinitrobenzene	1.25	2500	8330
1,3-Dinitrobenzene	0.313	625	8330
Methyl-2,4,6-trinitrophenyl-nitramine (Tetryl)	3.13	6250	8330
Nitrobenzene	0.313	625	8330
2,4,6-Trinitrobenzene	1.25	2500	8330
2,6-Dinitrotoluene	0.313	625	8330
2,4-Dinitrotoluene	0.313	625	8330
2-Amino-4,6-Dinitrotoluene	0.625	1250	8330
4-Amino-2,6-Dinitrotoluene	0.625	1250	8330
2-Nitrotoluene	0.625	1250	8330
4-Nitrotoluene	0.625	1250	8330
3-Nitrotoluene	0.625	1250	8330
Inorganics:			
Antimony	20	2.0	6010B
Arsenic	10	1.0	6010B
Barium	10	1.0	6010B
Beryllium	4.0	0.4	6010B
Cadmium	5.0	0.5	6010B
Chromium	10	1.0	6010B
Cobalt	10	1.0	6010B
Copper	20	2.0	6010B
Lead	5.0	0.5	6010B
Mercury	0.2	0.02	7470/7471
Nickel	40	4.0	6010B
Selenium	10	1.0	6010B
Silver	10	1.0	6010B
Thallium	10	1.0	6010B
Tin	10	1.0	6010B
Vanadium	10	1.0	6010B
Zinc	20	2.0	6010B
Cyanide	0.010	1.0	6010B
Sulfide	1.0	25	6010B

TABLE 5-1 *(continued)*

ANALYTICAL METHODS
LIVE IMPACT AREA
VIEQUES ISLAND, PUERTO RICO

Constituent	Quantitation Limits[a]		Method Number
	Water (µg/L)	Soil (µg/kg)	
Other:			
Picric Acid	2.6	1,000	8330
Ammonium Perchlorate	25	25	300.0 (IC)
Grain Size	NA	NA	ASTM D442
Bulk Density	NA	NA	ASTM D2937
Moisture Content	NA	NA	ASTM D2937

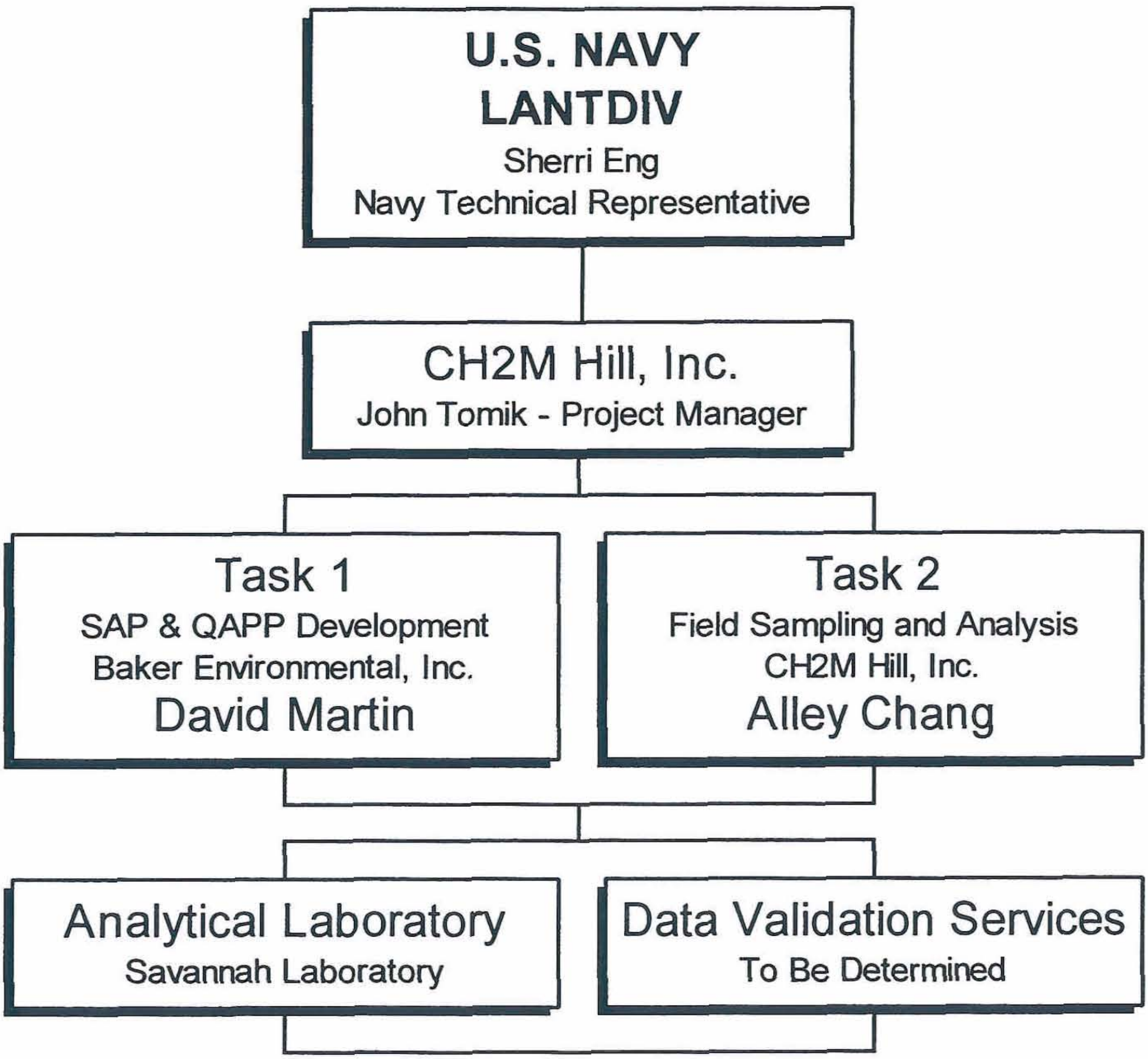
Notes:

a = Quantitation limits listed for inorganics in soil are based on wet weight. The quantitation limits calculated by the laboratory for soil, calculated on dry weight basis, will be higher.

NA = Not Applicable.

FIGURES

Figure 4-1
Reference Sites Sampling
Puerto Rico and US Virgin Islands



ATTACHMENT C
HEALTH AND SAFETY PLAN ADDENDUM

Final

HEALTH AND SAFETY PLAN
LIVE IMPACT AREA
VIEQUES ISLAND, PUERTO RICO

CONTRACT TASK ORDER 0397

JULY 24, 2000

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES
ENGINEERING COMMAND
Norfolk, Virginia

Under the:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Carpools, Pennsylvania

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HEALTH AND SAFETY PLAN

Project Information and Description

This Health and Safety Plan (HASP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. All field personnel are required to read this HASP and sign the form in Attachment 1 to verify comprehension of this document.

PROJECT NO: 62470-397
CLIENT: United States Navy
PROJECT/SITE NAME: Soil Sampling within the Live Impact Area (LIA)
SITE ADDRESS: Vieques Island, Puerto Rico
CH2M Hill PROJECT MANAGER: Mr. John Tomik
CH2M Hill OFFICE: Virginia Beach, VA
DATE HEALTH AND SAFETY PLAN PREPARED: June 16, 2000
DATE(S) OF SITE WORK: June 18, 19, & 20 (tentatively)
SITE ACCESS: The site is located at the eastern portion of Vieques Island, Puerto Rico.
SITE SIZE: 931 acres

Site Topography

The regional topography of Vieques consists generally of hills and valleys throughout the entire island. The western side of the island consists of gently rolling hills with a deeper soil profile than the eastern, more exposed rugged terrain. The highest point on the western side of the island is found at Monte Pirate with an elevation of 1,000 feet, while the highest point on the eastern side is found at Cerro Matias with an elevation of 420 feet. In addition to the terrain mentioned above, the coastal areas demonstrate their own topography. These areas contain level terrain primarily made up of lagoons and mangrove swamps.

Prevailing Weather

The climate of Vieques is characterized as warm and humid (tropical-marine), with frequent showers occurring throughout the year. The temperature on Vieques is affected by the easterly trade winds blowing across the island year-round. This wind moderates the temperature throughout the year, causing an annual mean temperature of 79° F to 80° F, and a mean daily temperature range of 15° F to 25° F. The average annual rainfall on the island is approximately 36 inches, with extremes being 25 inches in the east and 45-50 inches in the west.

Site Description and History

Vieques Island lies roughly seven miles southeast of the U.S. Naval Station Roosevelt Roads (NSRR), Puerto Rico. The U.S. Navy occupies approximately 22,600 acres of the roughly 33,000 acres making up Vieques Island. The 22,600 acres are broken up as follows: Naval Attachment Storage Depot (NASD) which consists of 8,000 acres along the western most tip of the island; the Eastern Maneuver Area (EMA) which consists of 11,000 acres located in the east-central portion of the island; the Atlantic Fleet Weapons Training Facility (AFWTF) which consists of 3,600 acres along the eastern portion of the island and the Live Impact Area (LIA) which consists of 931 acres along the eastern portion of the island.

The LIA is undeveloped and used for live fire training. Figure 3-1 within the Work Plan presents the location of LIA on Vieques.

1.0 TASKS TO BE PERFORMED UNDER THIS PLAN

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.1 Hazwoper-Regulated Tasks

- Surface geophysical surveys (UXO subcontractor)
  - Magnetic
- Surface soil sampling
- Surveying (GPS)

1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

POTENTIAL HAZARDS	Surface Soil Sampling	Surveying (GPS)	Geophysical surveying UXO Subcontractor
Flying debris/objects			
Noise > 85dBA			
Electrical			
Suspended loads			
Buried ordnance	X	X	X
Slip, trip, fall	X	X	X
Back injury	X		X
Confined space entry			
Trenches / excavations			
Visible lightning	X	X	X
Vehicle traffic			
Elevated work areas/falls			
Fires			
Entanglement	X	X	X
Drilling			
Heavy equipment			
Working near water	X	X	X
Working from boat			
IDW Drum Sampling			

1.3 Unexploded Ordnance (UXO)

Unexploded Explosive Ordnance (UXO): An item of explosive ordnance that has failed to function as designed or has been abandoned, discarded, or improperly disposed of and is still capable of functioning and causing damage to personnel or material is considered UXO. It is highly probable that UXO will be encountered at the LIA. An ordnance avoidance plan is presented in Attachment 2 of this HASP. All personnel must be familiar with the ordnance avoidance plan and Navy 802014-Explosives Safety Training prior to signing the Employee Sign-off Form provided in Attachment 3.

2.0 HAZARD CONTROLS

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M Hill employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M Hill employees and subcontractors who do not understand any of these provisions should contact the Site Health and Safety Officer (SHSO) for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in **Attachment 3**. These checklists are to be used to assess the adequacy of CH2M Hill and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments:
Complete self-assessment every 3 months throughout the duration of this project.

2.1 Project-Specific Physical (Safety) Hazards

The main physical or safety hazards posed to CH2M Hill personnel during project activities are:

- Unexploded ordnance (UXO).
- Rusted metals hazard.

UXO may be within the sampling areas. A UXO subcontractor will be procured to ensure the safety of field personnel by screening the sample locations for ordnance. General UXO screening procedures are presented within this section of the Draft HASP. A more detailed UXO avoidance plan will be provided by the UXO subcontractor upon procurement. The general UXO screening procedures to be followed are:

- The UXO subcontractor will prepare a UXO Avoidance Plan (A Sample UXO Avoidance Plan to be used as an example is presented in **Attachment 2**).

- The UXO subcontractor will conduct a safety meeting with the CH2M Hill sampling team before sampling begins.

- The UXO subcontractor will direct and assist the CH2M Hill sampling team in maneuvering within the LIA.

- The UXO subcontractor will conduct a visual surface survey of the travel routes and sample locations within the LIA.

- The magnetometer will be calibrated against a known source to ensure proper functionality.

- The UXO subcontractor will utilize a magnetometer to screen the surface soil sample location to a depth of 3-feet bgs.

- If the UXO subcontractor identifies potential ordnance, the sample location will be moved to a safe area designated by the UXO subcontractor.

Physical hazards may also be posed by picric acid. Although the crystalline form of this compound is shock sensitive and can explode, it will most likely be in the form of a residue which is not shock sensitive. The UXO subcontractor will visually inspect the sample location and determine if there is a picric acid hazard.

2.2 General Hazards

2.2.1 General Hazards and Housekeeping

- Site work will be performed during daylight hours whenever possible. Work conducted at night will require enough illumination to read a newspaper without difficulty.

- Hearing protection must be worn in areas where shouting is required to hear someone within 3 feet.

- Good housekeeping must be maintained at all times in all project work areas.

- Common paths of travel should be established and kept free from the accumulation of materials.

- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.

- Provide slip-resistant surfaces, ropes, and/or other devices.

- Specific areas should be designated for the proper storage of materials.

- Tools, equipment, materials, and supplies shall be stored in an orderly manner.

- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.

- Containers should be provided for collecting trash and other debris and shall be emptied at regular intervals.

- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

The SHSO is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M Hill using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M Hill subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M Hill employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.

It should be stated that because no decontamination is planned for this investigation, it is not anticipated that any chemicals will be brought on site. This section, however, has been included for completeness.

2.2.3 Shipping and Transportation of Chemical Products

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M Hill training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the SHSO or the Equipment Coordinator for additional information.

2.2.4 Manual Lifting

- Proper lifting techniques must be used when lifting any object (i.e. sample coolers).
  - Plan storage and staging to minimize lifting or carrying distances.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.2.5 Slips, Trips and Falls

- Institute and maintain good housekeeping practices.
- Pick up tool and debris in the work area.
- Walk or climb only on equipment surfaces designed for personnel access.

- Be aware of poor footing and potential slipping and tripping hazards in the work area.

2.2.6 Fire Prevention

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.

- The area in front of extinguishers must be kept clear.

- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.

- Combustible materials stored outside should be at least 10 feet from any building.

- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.

- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.7 Heat Stress

Preventing and Treating Heat Stress

- Drink 16 ounces of water before beginning work. Disposal cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Take regular breaks in a cool, shaded area. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.

- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).

- Use cooling devices, such as cooling vests, to aid natural body ventilation The devices add weight, so their use should be balanced against efficiency.

- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.

- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.

- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).

- Maintain good hygiene standards by frequently changing clothing and showering.

- Monitor buddy for signs of heat stress. Persons who experience signs of heat rash or heat cramps should consult the SSC to avoid progression of heat-related illness.

- Those who experience heat syncope (sudden fainting), heat exhaustion (hot, pale, clammy/moist skin), or heat stroke (red, hot, dry skin; loss of consciousness) must be cooled down immediately and provided cool water or sports drink. Persons who experience heat syncope or heat exhaustion should also seek medical attention as soon as possible. Persons who experience heat stroke must get immediate medical attention.

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.
The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

2.3 Biological Hazards and Controls

2.3.1 Snakes

No poisonous snakes are indigenous to Puerto Rico. Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. Following contact, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.5 Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or CPR. Exposure controls and personal protective equipment (PPE) are required. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.3.6 Other Anticipated Biological Hazards

The following paragraphs identify the potential hazards associated with flora and fauna at the LIA. If additional concerns are identified, they will be added to this HASP.

Hazardous Flora

Incidence of contact by individuals to poisonous/thorny plants (i.e., Acacia trees) is high; therefore, bare skin should be covered (i.e., long pants and shirt, steel toe boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas. Personnel should avoid entering an area of known poisonous flora; a secondary route should be selected. Care should also be taken when walking in such areas as uneven terrain or vines may present a tripping hazard.

Under no circumstances should attempts be made to cut into dense underbrush because of the UXO hazard. All rashes and other injuries will be reported to the SHSO as soon as they are known.

Hazardous Fauna

Mosquitoes and sand flies pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Sand fly bites that are repeatedly scratched can cause secondary infections. Avoiding the use of perfumes and scented deodorants and donning light colored clothing is preferable. The use of Avon's "Skin So Soft" or other insect repellent is encouraged.

There is a potential to come in contact with other dangerous insects; these include centipedes, fire ants, bees, wasps, hornets, mites, fleas, and spiders. All personnel should perform "checks" on each other periodically and at the end of the work shift, especially when working in grassy or forested areas. All insect bites must be reported to the SHSO.

Mongeese, rats, and mice have been documented to carry rabies. There is some evidence that mongeese can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for considerable time before succumbing to the disease. Any observed unusual behavior by mongeese and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies exhibit agitation and viciousness followed by paralysis and death. Those with dumb rabies exhibit lethargy and paralytic symptoms followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

Contact with surface water will be kept to a minimum. There have been several incidents of infection by schistosomes (blood flukes) from contact with surface water. The aquatic snail vector, *Australorbis glabratus*, transmits the schistosomes into surface waters, predominantly drainage ditches. Even momentary contact (especially in the presence of blisters, cuts, and open sores) with contaminated surface water is sufficient to acquire an infection. Accidental skin contact requires that the area be washed with isopropyl alcohol (as directed by SHSO). Symptoms of infection are fever, diarrhea, itchy skin, and CNS damage. Schistosomiasis is hard to treat and, once established in its host, may remain for several years.

Prior to initiating site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

Dengue Fever and Other Illnesses

According to the Centers for Disease Control, **Dengue Fever** is primarily a viral infection transmitted by mosquito bites in residential areas. The mosquitoes are most active during the day, especially around dawn and dusk, and are frequently found in and around human habitations. The illness is flu-like and characterized by sudden onset, high fever, severe headaches, joint and muscle pain, and rash. The rash appears 3 to 4 days after the onset of fever. Since there is no vaccine or specific treatment, prevention is important. To reduce mosquito bites, personnel should wear clothes that cover most of the body. Personnel should also take insect repellent with them to use on any exposed areas of skin. The most effective repellent is DEET (N,N-diethyl meta-toluamide). Avoid applying high-concentration DEET (greater than 35 percent) products to the skin and refrain from applying repellant to portions of the hands that are likely to come in contact with the eyes and mouth. Rarely toxic reactions or other problems have developed after contact with DEET. Please note that **personnel performing water sampling should refrain from using DEET because the breakdown products can show up as false positive results in lab analysis.** For greater protection, clothing can be soaked in or sprayed with PERMETHRIN, which is an insect repellent licensed for use on clothing. If applied according to directions, permethrin will repel insects from clothing for several weeks.

Traveler's Diarrhea is the most frequent health problem for travelers. It can be caused by viruses, bacteria, or parasites which are found universally throughout the region. Transmission is most often through contaminated food or water." Purchase food and beverages from vendors that are professional. Avoid small roadside stands and drink bottled beverages when possible. The use of over-the-counter or prescriptions medications can reduce the length of the attack.

Hepatitis A is a viral infection of the liver transmitted by the fecal oral route; through direct person to person contact; from contaminated water, ice, or shellfish; or from fruits or uncooked vegetables contaminated through handling. Symptoms include fatigue, fever, loss of appetite, nausea, dark urine, jaundice, vomiting, aches and pains, and light stools. No specific therapy, only supportive care is available. The virus is inactivated by boiling or cooking to 85 degrees centigrade for one minute, therefore eating thoroughly cooked foods and drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

2.3.7 Fire Ant Bites

Fire ants typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. However, it is possible that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention.

2.4 Radiological Hazards and Controls

The potential for radiological hazards at the LIA exists. It is expected that depleted uranium is present in the North Convoy area. As such, no sampling will be conducted in this area or any other area having the potential for radiological hazards.

2.5 Chemical Hazards

Hazardous chemicals can be absorbed into the body through various pathways. These pathways include:

- Inhalation of vapors, gases, or particulates.
- Ingestion of contaminated particulates from hand-to-mouth contact.
- Dermal and eye absorption from direct, unprotected contact, or from exposure to airborne concentrations.

Intravenous and intraperitoneal routes are also absorption pathways, but are not typical routes of concern for these types of activities. The pathway of greatest concern for potentially acute exposures would be inhalation.

There is no previous information on contaminants at the LIA. Chemical exposure potential for personnel involved with the field investigation is expected from explosives and inorganics. For the most part, sampling activities are not anticipated to create airborne particulates; therefore, inhalation hazards are expected to be low. For sampling activities, the primary route of entry will be from ingestion. The following table identifies the chemical and physical properties of the primary contributors to the total Hazard Indices (HIs). Chemicals are listed for those media which will be sampled during the proposed investigation.

Chemical[a]	Hazard Rating[b]	volatility[c]	Skin Absorp[d]	Carc.[e]	TLV[f]	IDLH[g]	IP[h]
	H F R						
2,4,6-Trinitrotoluene	3 2 1	0.0002	Yes	Yes	0.5 mg/m³	500 mg/m³	10.59eV
Lead	3 1 0	NA	NO	NO	NO	10 mg/m³	NA

Notes:

(a) Chemical compound of potential concern obtained from previous investigation.
(b) Hazard Rating – Based upon Health (H), Fire (F), or Reactivity ® hazard from NFPA 704 Standard Rating system (0 = no hazard, 4 = high hazard)
(c) Volatility Rating – based upon vapor pressure in mm Hg at 68F, 20C
(d) Skin Adsorption – "Yes" indicates potential exposure through skin and mucous membranes, either by airborne or, more particularly, by direct contact - ACHIH
(e) Carcinogen – "Yes" indicates a compound is a confirmed or suspect human carcinogen by the IARC, NIOSH, NTP, EPA or ACGIH
(f) TLV – Threshold Limit Value from the 1998 TLV – Threshold Limit Value of the ACGIH or OSHA Permissible Exposure Limits (PEL), whichever is lower
(g) IDLH – Immediately Dangerous to Life and Health.
(h) IP – Ionization potential – expressed in election volts (eV)

2.6 UXO Hazards

The potential for encountering unexploded ordnance is high. Please see Attachment 2 – Ordnance Avoidance Plan.

3.0 Project Organization and Personnel

3.1 Employee Medical Surveillance and Training

The employees listed below are enrolled in the CH2M Hill's Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Employee Name	Office	Responsibility	SSC/FA-CPR
Mr. John Tomik	Virginia Beach	Project Manager	Level D; FA-CPR
Ms. Alley Chang	Virginia Beach	Field Team Leader	Level D; FA-CPR
TBD	TBD	Field Team Member	Level D; FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: **Ms. Sherri Eng**
Phone: (757) 322-4787
Facility Contact Name: N/A
Phone: N/A

3.2.2 CH2M Hill, Inc.

Project Manager: John Tomik
Health and Safety Manager: TBD
Field Team Leader: Ms. Alley Chang
Site Health and Safety Officer: Mr. Marty Clasen
SHSO is responsible for contacting Field Team Leader and Project Manager. In general, Project Manager will contact client. The Health and Safety Manager should be contacted as appropriate.

3.2.3 CH2M Hill Subcontractors

Subcontractor Service	Company Name	Contact Name	Phone Number
UXO	Blackhawk	Mr. Larry Wilson	

The ordnance subcontractor is covered by this HASP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., ordnance detection). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M Hill for review before the start of field work. This document (Ordnance Avoidance Plan) will be provided by the UXO subcontractor upon procurement (an example of an Ordnance Avoidance Plan is presented in Attachment 1) specific to their work. Subcontractors must comply with the established health and safety plan(s). The CH2M Hill SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M Hill's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M Hill will continuously observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M Hill is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SHSO is responsible for assessing CH2M Hill's subcontractor performance.

Health and safety related communications with CH2M Hill's subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Sheet included in Attachment 1.

- The ordnance subcontractor is required to brief the project team on the hazards and precautions related to their work.

- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.

- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.

- When an apparent imminent danger exists, immediately remove all affected CH2M Hill employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager as appropriate.

- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4.0 Personal Protective Equipment

Personal protective equipment (PPE) will be Level D for general site entry and GPS surveying and modified Level D for surface soil sampling. The following table presents the PPE specification for the field event.

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
General site entry Surveying Observation of material	D	Work clothes; steel-toe, leather work boots.	Hardhat [c] Safety glasses Ear protection [d]	None required
Surface soil sampling	Modified D	Tyvex **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile. **Vehicle:** 20 mil plastic or equivalent placed on the floors of vehicles.	Hardhat [c] Safety glasses Ear protection [d]	None required

[a] Modifications are as indicated.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SSC.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

5.0 DECONTAMINATION

As only disposal sampling equipment will be used, no decontamination is planned for this investigation.

6.0 SITE-CONTROL PLAN

6.1 Site-Control Procedures

- The SHSO will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.

- Topics for briefing on site safety include: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.

- The SHSO records attendance at safety briefings in a logbook and documents the topics discussed.

- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.

- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available

- Establish offsite communication.

- Establish and maintain the "buddy system."

- Initial air monitoring is conducted by the SHSO in appropriate level of protection.

- The SHCO is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

6.2 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards; and therefore, require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.

- When non-Hazwoper-trained personnel are at risk of exposure, the SHSO must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site

- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.

- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.

- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

7.0 EMERGENCY RESPONSE PLAN

7.1 Pre-Emergency Planning

The SHSO performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M Hill's onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SHSO will evaluate emergency response actions and initiate appropriate follow-up actions.

7.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	N/A

7.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M Hill's operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

7.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 8.8 (e.g., 911).
- The SHSO will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.

- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.

- Make certain that the injured person is accompanied to the emergency room.

- When contacting the medical consultant, state that the situation is a CH2M Hill matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.

- Report incident as outlined in Section 8.7.

7.5 Evacuation

- Air-Lift. No medical support will be made available by the Department of the Navy.

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the hospital route map (to be provided in the final document).

- Evacuation route(s) and assembly area(s) will be designated by the SHSO before work begins.

- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.

- The SSC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.

- The SSC will account for all personnel in the onsite assembly area.

- A designated person will account for personnel at alternate assembly area(s).

- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

7.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

7.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M Hill work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M Hill subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

7.8 Emergency Contacts

Emergency contacts will be determined prior to project startup.

8.0 APPROVAL

This site-specific Health and Safety Plan has been written for use by CH2M Hill only. CH2M Hill claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

8.1 Original Plan

Approved By:______________ Date: ______________

8.2 Revisions

Revisions Made By: Date:
Revisions to Plan:
Revisions Approved By: Date:

9.0 ATTACHMENTS

Attachment 1: Employee Signoff Form – Health and Safety Plan

Attachment 2: Sample Ordnance Avoidance Plan

Attachment 3: Subcontractor Safety Performance Questionnaire

ATTACHMENT 1

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M Hill project employees and subcontractors listed below have been provided with a copy of this FSI, have read and understood it, and agree to abide by its provisions.

Project Name: **Project Number:**

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

TABLE OF CONTENTS

Chapter 1: General

1.0 INTRODUCTION

This UXO Avoidance Plan describes the procedures, methods and resources Blackhawk Geometrics will use while performing Ordnance Avoidance escort operations at the NASD, Vieques Island, Puerto Rico. Authorization for performance of this work is contained in the CH2M Hill Purchase Order Number 36262 dated April 5, 2000.

1.1 PURPOSE

The purpose for this Avoidance Plan (AP) is to define the UXO avoidance procedures and methods that Blackhawk Geometrics will use to perform the work associated with this operation.

1.2 SCOPE

This AP is an all-inclusive document, which has been tailored to the requirements of this operation. All site operations/work will be executed in accordance with this plan and any deviation from this plan requires the prior approval of both Blackhawk Geometrics and CH2M Hill.

Chapter 2: Statement of Work

2.0 GENERAL STATEMENT OF WORK

Blackhawk is to provide ordnance avoidance for CH2M Hill environmental sampling operations on Vieques Island, Puerto Rico. The following requirements were extracted:

2.1 WORK SITES

This SOW pertains to UXO Escort operations in the following areas:

- SWMU-04
- SWMU-05
- SWMU-06
- Live Impact Area (LIA)

The purpose of this phase of work is to provide UXO Escort operations in the aforementioned areas.

2.2 OBJECTIVE

To safely locate, identify and mark UXO and OE located on the surface within the project site and to monitor the collection of soil samples and borings to a depth commensurate with the detection capabilities of the instruments used.

2.3 DESCRIPTION OF SERVICES

2.3.1 Task 1: Plans Preparation

Blackhawk Geometrics shall prepare and shall submit a UXO Avoidance Plan for approval prior to commencing site activities.

2.3.2 Task 2: Mobilization, Health and Safety Training and Site Orientation

Upon mobilizing to the site, all Blackhawk Geometrics personnel will participate in site operations and orientation training to be conducted by CH2M Hill.

2.3.3 Task 3: Ordnance Escort

This Task shall be accomplished in accordance with the UXO avoidance Operations Plan and "U.S. Army Corps of Engineers, Huntsville Division, Safety Concepts and Basic Considerations for Unexploded Explosive Ordnance (UXO) Operations, Rev. 16Dec92".

2.4 PERSONNEL QUALIFICATIONS AND JOB DESCRIPTIONS

Blackhawk Geometrics shall furnish a staff that is qualified through education, training and pertinent experience that shall accomplish the objective and tasks of this SOW.

2.4.1 29CFR1910.120 Certification

All personnel shall have current certification in accordance with 29CFR1910.120 (e) and (f).

2.5 SUBMITTALS

Submittal	Due Date
UXO Avoidance Plan	Prior to commencing operations

2.6 SPECIAL INSTRUCTIONS

During field activities on ordnance projects, hard hats need not be worn unless a head injury threat is present.

Chapter 3: UXO Operational Plan

3.0 INTRODUCTION

This Plan outlines the procedures Blackhawk Geometrics will use to perform UXO Avoidance and Escort operations at the NASD Facility, Vieques Island, Puerto Rico.

3.1 GENERAL

Blackhawk Geometrics will escort CH2M Hill personnel at the NASD Facility, Vieques Island, Puerto Rico focusing on safety as the paramount concern and using proven operating techniques and methods.

3.2 MOBILIZATION

Blackhawk will mobilize the necessary personnel and equipment to San Juan, Puerto Rico on April 9, 2000.

3.2.1 Personnel

Blackhawk will deploy one UXO III (Supervisor), Mr. Larry P. Wilson. Mr. Wilson has over 25 years' combined active duty Navy EOD and commercial UXO experience and is currently employed as the lead UXO III for Blackhawk Geometrics. Mr. Wilson's Resume is attached.

3.2.2 Project Equipment

Blackhawk will furnish a Schonstedt GA52Cx metal detector to assist the UXO III in performing avoidance operations.

3.2.3 Communications Equipment

Blackhawk assumes that all communications equipment will be provided by CH2M Hill.

3.2.4 Explosive Storage

Blackhawk Geometrics requires no explosive storage.

3.2.5 Site Specific Training

Site specific training will comprise site orientation and operations briefings to be conducted by CH2M Hill operations personnel. The Blackhawk UXO III will brief CH2M Hill personnel on general UXO safety as it relates to the Vieques operations.

3.3 OPERATIONS

Immediately upon completion of mobilization activities, Blackhawk will begin supporting sampling operations. Blackhawk anticipates performing the following activities:

- Support a geophysical survey of SWMU-04 and SWMU-06 by conducting a surface, visual search for UXO/OE;

- Support soil sampling and boring activities in SWMU-05 by performing a surface visual search for UXO/OE at the sampling site and performing a subsurface magnetometer search of the sampling site using the Schonstedt metal detector;

The following sub-paragraphs describe the general work practices that Blackhawk will follow during all operations and the specific procedures and methods Blackhawk will use to perform the activities listed above.

3.3.1 General Site Practices

Qualified UXO personnel will perform all operational UXO activities at Vieques.

3.3.1.1 Work Hours

Operations will be conducted during daylight hours only. The daily work routine and times will be coordinated between the UXO Technician and the CH2M Hill on-site representative.

3.3.1.2 Site Access

Overall site access is controlled by the USN. The CH2M Hill operational leader will strictly control access into operating areas and will limit access to only those personnel necessary to accomplish the specific operations or who have a specific purpose and authorization to be on the site.

3.3.1.3 Handling of UXO

It is not anticipated that any UXO will need to be handled or moved from the location where it is found. In the event that safety requires handling of UXO, only the UXO III will handle or move UXO. Non-UXO personnel will be admonished at each day's tailgate safety briefing not to handle, move or pick-up anything which resembles UXO or OE.

3.3.1.4 Safety Training/Briefing

Blackhawk will conduct the UXO portion of the daily safety briefing (tailgate safety briefing). The UXO Technician will immediately communicate all safety issues to all personnel if the issue has immediate safety concerns.

3.3.1.4.1 Visitor(s) Safety Briefings

Site visitors must receive a safety briefing prior to entering the operating area and must be escorted at all times. UXO operations will cease when visitors are in the vicinity.

3.3.1.5 Safety and Environmental Violations

Safety violations, unsafe acts and blatant disregard for environmental regulations will be immediately reported to the CH2M Hill Project Manager for appropriate action.

3.3.1.6 Work Clothing and Field Sanitation

Work clothing will be appropriate for the conditions encountered on any particular site. In most cases, this will be Level D PPE.

- Footwear will be work boots. (Steel toes are not required for this project)

- Hand protection will consist of leather or canvas work gloves.
- Safety glasses, face shields, respirators, hearing protection, hard hats and protective chaps or aprons will be worn when engaged in activities where their use is prudent or required.
- In no case will tennis shoes/running shoes or abbreviated attire such as shorts or tank tops be permitted.

3.3.2 Site Layout

The overall OE sweep site boundaries will be established and marked by CH2M Hill.

3.3.3 Search Operations

3.3.3.1 Equipment

The equipment requirements for this task include:

- Schonstedt GA-52Cx Series Magnetometer
- Marking tape and pin flags
- Machete
- Forms and logbooks to record activities

3.3.3.2 Search Procedures

The UXO III will perform a visual surface search for UXO/OE ahead of any geophysical equipment teams or sampling/boring teams. The UXO III will pay particular attention to those areas where personnel will be walking or operating equipment.

3.3.3.3 Soil Sampling and Boring

The UXO III will search the sampling/boring site with the metal detector to determine that there is no potential UXO immediately beneath the sampling/boring site.

3.3.4 ON-SITE/OFF SITE EMERGENCIES

3.3.4.1 On-Site Emergencies

The UXO III will be the on-site coordinator in the case of a UXO accident or incident, which requires an emergency response. Emergency contact phone numbers will be posted and kept readily available. All personnel will be briefed and know the location of all communications devices on the site. Emergency contact phone numbers and emergency route to the nearest medical facility are reflected in the Site Specific Safety and Health Plan (SSHP). A warning system, which uses a series of three (3) short, blasts on a portable air horn and/or vehicle horn will notify site personnel that an accident or incident has occurred and that evacuation is required. Upon hearing the evacuation warning, all personnel will immediately cease operations and egress the site through the planned emergency route and will gather at the designated assembly area. The Site Specific Safety and Health Plan will define the evacuation routes and assembly points. At the assembly point, personnel will be accounted for and interviews will be conducted to determine if anyone has sustained injuries as a result of the incident. If an emergency response rescue is required, no one will re-enter the area until the situation has been assessed and it is determined that the assets are available to effect a rescue without jeopardizing additional personnel. The following actions will be accomplished prior to attempting an emergency response and/or rescue:

- An emergency response vehicle will be designated and will remain on site during field operations.
- The Buddy System will be strictly enforced. No one will enter the exclusion area alone.
- All victims will be located and their condition assessed so that transportation and medical support requirements can be determined.
- Outside emergency response agencies will be placed on stand-by.
- Assess the situation to determine the potential for additional hazards.
- Remove injured personnel from the hazard area as quickly as practicable. If decontamination is required, decontaminate only after the medical condition has been stabilized. If the injury poses immediate threat to the victim's life, decontamination may not be accomplished prior to movement of the victim. If contamination is suspected, perform whatever measures possible to prevent or limit the spread of contamination.
- Further details of the emergency response approach are contained in the Safety Plan.

3.3.4.2 Off-Site Emergencies

Accidents or incidents occurring off-site will be reported to the local authorities immediately. The caller will provide the following information to the emergency operator:

- Name of caller
- Nature of the accident/incident
- Present situation and type of response required

3.4 PHASE 3: DEMOBILIZATION

Upon satisfactory completion of the requirements of the SOW, Blackhawk Geometrics shall remove all personnel, equipment, and supplies from the site.

3.4.1 Project Documentation

Logbooks, field notes and other documentation (paper and electronic) will be collected and stored in a central location at the Blackhawk Geometrics, Golden, Colorado office. For all site work, field personnel will use bound logbooks with consecutively numbered pages. The field logbooks will be used to record the daily activities of the field team, provide sketch maps and locations of UXO and other pertinent items. The field log books and site records are utilized to record the following:

- **Daily Journal**: The UXO Supervisor will maintain the Daily Journal. This journal will provide a summary of all operations conducted to include information on weather conditions, problem areas, work plan modifications, injuries, start/stop times, tailgate safety briefings, equipment discrepancies, UXO/OE located, training conducted, visitors and any additional items deemed appropriate.

Larry P. Wilson

Current Position: UXO Supervisor (DOL UXO III)

Joined Blackhawk: MAY 1999

Summary Information: Mr. Wilson has over 22 years' combined active duty EOD and commercial UXO experience. He has worked on the Chino Hills project since October 1996, occupying various billets including UXO Specialist, UXO Team Leader and UXO Health and Safety Officer and Senior UXO Supervisor.

PRINCIPLE DUTIES AND RESPONSIBILITIES

Perform: reconnaissance and classification of UXO; identification of U.S. and foreign guided missiles; bombs and bomb fuzes; projectiles and projectile fuzes; grenades and grenade fuzes; rockets and rocket fuzes; land mines and associated components; pyrotechnic items; military explosives and demolition materials. Supervise: the location of subsurface UXO using military and/or civilian magnetometers. Supervises the excavation and recovery of subsurface UXO; construction of UXO-related protective works; the location of surface UXO by visual means; transporting and storing UXO assuring compliance with Federal, state, and local laws; disposal of UXO by burning/detonation; preparation of an UXO disposal site; preparation of an on-site safe holding area for UXO. Determine UXO-related storage compatibility. Prepare an explosive storage plan. Supervise donning and doffing of personal protective equipment; operation of a personnel decontamination station; maintenance and operator checks on all team equipment. Prepare UXO related administrative reports; standard operating procedures. Conduct daily team safety briefing. Supervise: segregation of UXO-related scrap from non-UXO related scrap; safe handling procedures; team preventive medicine and field sanitation procedures. Perform risk hazard analysis; interpret x-ray of UXO. Supervise: field expedient identification procedures to ID explosive contaminated soil; the determining of a magnetic azimuth using a lensatic compass; emergency leak sealing and packaging of chemical warfare material.

BACKGROUND:

Eleven months, **Blackhawk Geometrics, Inc.** UXO Supervisor. Supervisor and Site Health and Safety Officer for UXO project requiring the clean closure of a former ammunition manufacturing site. Performs and supervises UXO team in the location, recovery and disposal of UXO/OE.

Two years, **Wyle Laboratories**. UXO Specialist, UXO Supervisor and Site Health and Safety Officer. Supervised ordnance location, recovery and disposal operations for UXO projects at Oceanside, CA., Coronado, CA and Chino Hills, CA. UXO team member and team leader on multi-team UXO remediation effort at Chino Hills, CA. Locates, identifies, recovers and disposes of UXO/OE. Performs QA/QC tasks on UXO projects.

Larry P. Wilson Resume Continued

Fourteen months, **CMS Environmental**, UXB, Int. at Ft. Ord, CA. Intrusive sweep team member, disposal/demolition team member. Responsible to locate, identify, recover and dispose of UXO/OE on ordnance remediation project.

Five years, **Police Officer**, Charleston SC. Served Charleston community as Patrol Officer up to grade of Lieutenant, Watch Commander. Team leader/supervisor for Bomb Disposal Team.

Two years, Officer in Charge (CWO3) **EODMU SIX DET 12**, US Navy. Master EOD Technician. Supervised shipboard EOD Detachment in support of fleet and combat operations. Performed various EOD missions, supported Operation Just Cause (Panama) and provided USSS (Secret Service) support to the President of the United States.

Two Years, Officer in Charge (CWO2) **EODMU SIX DET TEN**. Conducted overt and covert operations. Managed EOD Team for Atlantic, NATO, and SWA operations including Operation Good Will (Persian Gulf Mine Clearance). Developed and received approval for undersea mine location and disposal procedures on foreign mines encountered in the SWA.

Two Years, **EOD Group ONE Det. Bangor**, WA. US Navy. Senior enlisted Master EOD Technician. Supervised ammunition and classified component disposal operations, Conducted and supervised range clearance operations. Detachment Safety Officer.

Three Years, **EOD MU TWO**, FT. Story, VA, US Navy, Senior enlisted Master EOD Technician. Supervised ordnance recovery and disposal operations. Conducted extreme cold temperature diving operations for crashed aircraft recovery. Command Training Officer.

Two Years, **EOD Group ONE Det Bangor**, WA. US Navy. Senior EOD Technician and EOD Team member. Conducted recovery and disposal operations of 28 tons NEW of WW II ordnance from harbor. Conducted range clearance operations.

Three Years, **EOD MU ONE**, Barbers Point, H, US Navy. Basic EOD Technician. Conducted Special Weapon test EOD support. Participated in numerous range clearances and operations on Kaho'olawe Island.

EDUCATION:

U.S. Naval School, Explosive Ordnance Disposal , Basic EOD Course-1976
U.S . Navy Commissioned Officers Indoctrination Course-1986
EOD Advanced Courses
HAZ-MAT Packaging/Shipment Certification-1987
40 Hour OSHA 1910.120 Certified
8 Hour Hazardous Waste Supervisor Certified- Current
CPR/First Aid Certified-Current

ATTACHMENT 3: SUBCONTRACTOR SAFETY PERFORMANCE QUESTIONNAIRE

Name of Subcontractor:	______________________
Address of Subcontractor:	______________________
Contact Name:	______________________
Phone Number:	______________________
Standard Industrial Classification (SIC) Code:	______________________
Date:	______________________

HEALTH AND SAFETY

1. **YEAR**	**199__**	**199__**	**199__**
a. Number of Fatalities	____	____	____
b. Lost Work Day Cases Incident Rate[1]	____	____	____
c. OSHA Recordable Incident Rate[2]	____	____	____
d. Number of Hours Worked	____	____	____
e. Total Number of Employees on Your Payroll	____	____	____

ATTACHMENT 3: SUBCONTRACTOR SAFETY PERFORMANCE QUESTIONNAIRE

f. Attach a copy of your OSHA No. 200 logs for the last three (3) years.

g. CH2M Hill requires all subcontractors to provide the above accident statistics, even though certain companies may not be statutorily required to keep OSHA 200 logs.

[1] The following formula is used for calculating the Lost Work Day Incident Rate: $= \frac{\text{Number of Lost Work Day Cases x 200,000}}{\text{Number of Hours Worked}}$

[2] The following formula is used for calculating the OSHA Recordable Incident Rate: $= \frac{\text{Number of Recordable Cases x 200,000}}{\text{Number of Hours Worked}}$

2. List your company's Worker's Compensation (WC) Experience Modification Rate (**EMR**) for the three (3) most recent years:

		Interstate	Intrastate
a.	199___	___	___
b.	199___	___	___
c.	199___	___	___

d. Provide a letter from your WC insurance carrier certifying the above EMRs.

e. If your WC carrier has not issued your company an EMR because you have not accrued enough WC costs, provide a copy of your WC Loss Run (available from your WC carrier).

f. If your current EMR is greater than 1.0, provide a written explanation of the safety methods that are being implemented by your company to reduce this rate.

ATTACHMENT 3: SUBCONTRACTOR SAFETY PERFORMANCE QUESTIONNAIRE

3. List all activities your company will be performing on CH2M Hill Projects:

____

____

____

4. Has your company received an OSHA (or State OSHA) citation within the last five (5) years?

Yes ____ No ____

If you answered yes above, provide the following information below or on additional sheet if necessary:

a. The number and type of violations?_______________________________

b. The penalties assessed by OSHA? _______________________________

c. Were the citations contested/vacated? _______________________________

d. What specific corrective actions were taken to prevent further penalties/injuries?

____

____

5. Does your company have a written occupational safety and health program?

Yes ____ No ____ We reserve the right to request copies of your health & safety program.

6a. Does your company conduct field safety inspections to determine compliance with applicable regulations and procedures?

Yes ____ No ____

b. Who conducts these inspections? _______________________

c. How often are safety inspections conducted? _______________________

ATTACHMENT 3: SUBCONTRACTOR SAFETY PERFORMANCE QUESTIONNAIRE

7. Does your company have the following on your staff or on retainer?

	Yes	How Many	Staff	Retainer	No
Occupational Physician*	___	___	___	___	___
Certified Industrial Hygienist	___	___	___	___	___
Certified Safety Professional	___	___	___	___	___
Certified Health Physicist	___	___	___	___	___

* Board Eligible or Board Certified

8. Does your company have an orientation program for new hires? Yes ____ No ____

9. Has your company implemented any of the following training programs?

Yes	No	N/A		Yes	No	N/A	
☐	☐	☐	Asbestos	☐	☐	☐	Hazardous Waste (40-hour)
☐	☐	☐	Blasting/Explosives	☐	☐	☐	Hearing Conservation
☐	☐	☐	Bloodborne Pathogens	☐	☐	☐	Heavy Equipment operation
☐	☐	☐	Confined Space Entry	☐	☐	☐	Laboratory Safety
☐	☐	☐	Construction (OSHA Certified 10 Hours)	☐	☐	☐	Ladder/Scaffolding
☐	☐	☐	Construction (OSHA Certified 30 Hours)	☐	☐	☐	Lead
☐	☐	☐	Cranes Operations	☐	☐	☐	Lockout/Tagout
☐	☐	☐	Electrical Safety	☐	☐	☐	Personal Protective Equipment
☐	☐	☐	Excavation Competent Person	☐	☐	☐	Powder-actuated Tools
☐	☐	☐	Fall Protection	☐	☐	☐	Process Safety Management
☐	☐	☐	Fire Extinguishers	☐	☐	☐	Radiation Protection
☐	☐	☐	First Aid/CPR	☐	☐	☐	Respiratory Protection
☐	☐	☐	Forklift Operations	☐	☐	☐	Welding/Cutting

ATTACHMENT 3: SUBCONTRACTOR SAFETY PERFORMANCE QUESTIONNAIRE

10. Does your company have a program in place to discipline workers that perform unsafe work practices? Yes ____ No ____

11. Does your company have written Accident Investigation Procedures? Yes ____ No ____

12. Does your company currently maintain a program in compliance with applicable state "Right to Know" laws and the OSHA Hazard Communication Standard? Yes ____ No ____

13. Does your company currently maintain an Accident Prevention Program in compliance with applicable state OSHA regulations? (Required for Alaska, California, Minnesota, Nevada and North Carolina) Yes ____ No ____ N/A ____

14. Does your company implement a medical surveillance program for employees that work on hazardous waste sites or with hazardous chemicals (i.e., lead, asbestos, benzene, arsenic, formaldehyde, etc.)? Yes ____ No ____ N/A ____

5a. Does your company hold "tailgate/toolbox" safety meetings? Yes ____ No ____

b. If yes, how often? ______________________

ATTACHMENT 3: SUBCONTRACTOR SAFETY PERFORMANCE QUESTIONNAIRE

16. Has your company worked for CH2M HILL in the past three years? Yes ____ No ____

If so, what year and what project manager were you working for?

Year: ____________ Project Manager: ______________________________

17. The undersigned warrants and represents the data provided in this document is accurate in all respects.

Name of Firm: ______________________________

Completed by: ______________________________

Title: ______________________________

Date: ______________________________

CH2M Hill use only

Reviewed by: ______________________________ Date: ______________

Acceptable: ☐ Yes ☐ No If no, please send to Regional HSM for review.

Entered into database by: ______________________ Date: ______________